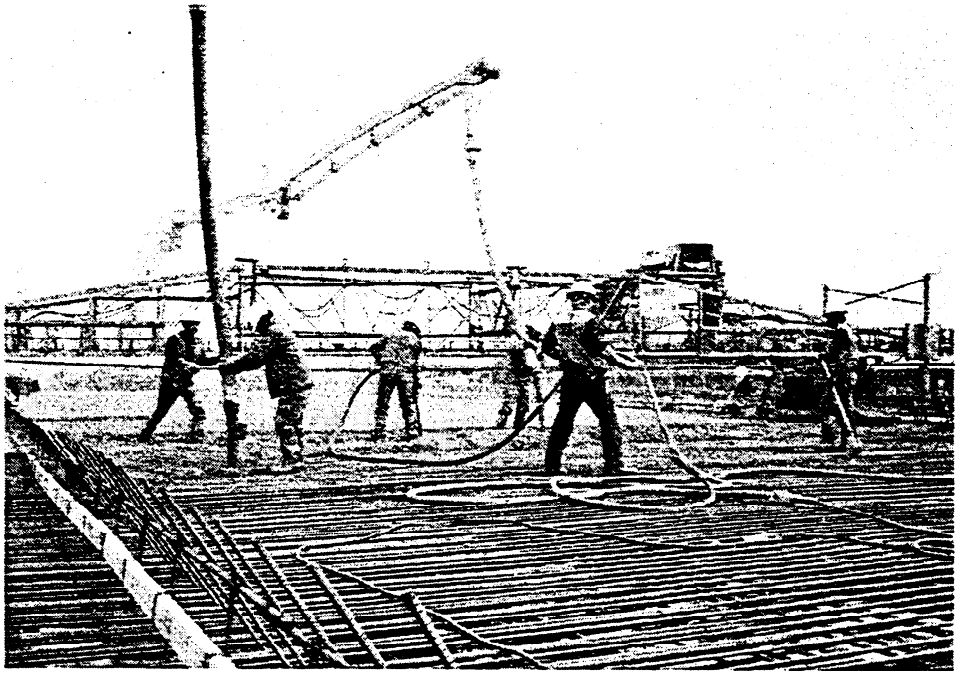
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF STRUCTURES
OFFICE OF STRUCTURE CONSTRUCTION

BRIDGE DECK CONSTRUCTION MANUAL



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DECK CONSTRUCTION MANUAL

PREFACE

This manual is intended to serve as a guide and a reference source for Bridge Engineers and others involved in engineering and inspection of bridge decks under construction.

Most of the manual is devoted to construction techniques that will produce the structural quality and ride characteristics required by the 1988 Standard Specifications. References are made to the 1988 Standard Specifications and the Bridge Construction Records and Procedures Manual throughout the text to facilitate the readers use of this manual. There are also numerous tips and valuable information included in the appendix that is a compilation of the knowledge and wisdom gained from the experiences of Caltrans Bridge Engineers over the years.

SECTION 1

PRECONSTRUCTION PLANNING

1-1 INTRODUCTION

Preconstruction planning at the beginning of a project will ensure that the deck is constructed in accordance with the Standard Specifications and also can help detect problems that might arise during construction. Preconstruction planning includes:

(1) Discussions and a conference with the Contractor,

(2) Review of our responsibilities

(3) Familiarization with the plans and specifications that relate to the planned work.

The subject of bridge deck construction may be introduced at the preconstruction conference especially if there are any unusual conditions. The deck construction conference with the Contractor should be scheduled prior to stem and soffit construction. The discussion at the preconstruction conference might include such items as scheduling, grade control, access and operational considerations, falsework requirements, sequence of concrete placement, and concrete quality control and strength requirements.

After the preconstruction conference, the following items should be reviewed by the Structure Representative:

1-2 CONCRETE MIX AND MATERIALS

A complete discussion of concrete mixes and materials can be

found in the "Concrete Technology Manual". The following is an abbreviated list of pertinent items:

1-2.1 AGGREGATES (Standard Specifications 90-2&3)

1. Source
2. Natural. or manufactured
3. Testing and gradation
4. Quantity available
5. Moisture control
6. Lightweight concrete

1-2.2 WATER CEMENT RATIO

1. Aggregate particle size and configuration
2. Admixtures
3. Strength requirements (contract plans)

1-2.3 ADMIXTUROES (Standard Specifications 90-4 or Specials)

1. Type(s) specified
2. Type(S) permitted (Bridge Construction Records & Procedures 100-4)
3. Compatibility of types
4. Effect on strength, shrinkage and workability
5. Testing and approval (prior to incorporating in work)
6. Dispensing and calibration

1-2.4 MIX DESIGNS AND TRIAL BATCHES (Standard Specifications 90-l&9)

1. Mix designs submitted by the Contractor and approved by the Structure Representative

2. Cement content and strength requirements (bridge decks 7-sack min.)
3. Admixture(s)
4. Combined grading of aggregates
5. Type of cement
6. Workability, placing and finishing characteristics
7. Scheduling of-trial batches
8. Uniformity (Using the same concrete mixes as other projects supplied by the same plant).

1-3 BATCH PLANTS (Standard Specifications 90-5&6)

A field review of the Contractor's proposed batch plant should be made at an early stage in the contract for specification compliance. This review is usually made by District personnel, using forms HC-12 & HC-14, (sample in Appendix 1).

It is a good idea for Structure's personnel to be aware of what the review involves, and to also check the following items:

1. Aggregate storage and handling (intermingling, contamination, moisture control, etc.)
2. Cement storage (protection, weighing, venting, sampling, quantity available, etc.)
3. Admixture(s) (introduction and measurement)
4. Water (adjustment for aggregate moisture content variation)
5. Plant equipment and measuring devices (compliance with specifications, condition and maintenance)

6. Transit-mix trucks (compliance with specifications, capacity, condition and maintenance)
7. Hot and/or cold weather provisions
8. Production capacity and haul time
9. Inspection facilities provided
10. Delivery ticket format and information

1-4 DECK CONSTRUCTION CONFERENCE

Prior to stem and soffit forming, a meeting should be held with the Contractor to discuss the particular features of the deck being constructed.

It is important that the Engineer understand the Contractor's proposed methods so that he can determine if these methods are compatible with the specifications and requirements of the contract. This is the time that any differences should be resolved. The Engineer should also discuss any contingency plan that the Contractor has for problems that may arise.

The following is a general outline of what this meeting might entail but the particulars of each job are the responsibility of the Engineer to determine and bring out in discussion:

1-4.1 SEQUENCE AND LIMITS OF PLACEMENT

1. Do the plans and specifications require certain sequences?
2. Does the Contractor plan on any wide pours?
3. Will the Contractor place any longitudinal or transverse

joints other than those shown on the plans? (Standard Plans BO-5)

4. Are longitudinal joints located on or close to a lane line?
5. Is stage construction required?
6. Are there any long standing hinges? (Appendix 2)
7. What quantity of concrete is required for the various deck segments?
8. Will placement interfere with public traffic, existing power lines or other obstructions?
9. In what direction is the pour?
10. Are there any closure pours?
11. Does the contract provide for falsework release alternatives?

1-4.2 LOCATION OF FINISHING MACHINE RAIL SUPPORTS AND CONSTRUCTION JOINTS

1. Where does the Contractor plan on placing the rail supports for the strike-off machine?
   a. edge of deck
   b. at longitudinal construction joints.
   c. at exterior or intermediate girder location.
2. Type of structure may influence screed rail position and support.
3. Refer to details for longitudinal. joints in the Standard Plans. (Location at the girder is preferred Standard Plans BO-5)
4. Evaluation of the support system of screed rails for deflection, rotation, and stability.

5. Grade control at longitudinal and transverse construction joints?
6. Grade control for screed rails and method of establishing grade.
7. Stability of bulkheads for construction joints.

1-4.3 CONCRETE CONVEYANCE, PLACEMENT METHOD AND RATE

1. Length and time of haul from batch plant to construction site.
2. Can the concrete be delivered at a uniform rate?
3. Will delivery, placement, and finishing of concrete cause a hazard to the public?
4. After delivery to the site, what placing method will be used to place the concrete in the deck? (pump, crane, belt, etc.)
5. Will the placing method require additional support considerations in the formwork or reinforcing steel? (i.e., are belts supported by the lost deck system)
6. Rate of placement anticipated - Is this consistent with the rate of delivery and how will this affect the surface finishing capabilities?
7. Proper vibration of concrete after placement (number of vibrator men).
8. Penetration required - How will this affect method of placement (pumping) or the capability of the strike off machine to properly work a given penetration concrete.

(Standard Specifications 90-6.06)

9. will conveyance and placement be interrupted for any reason such, as moving the placing and/or finishing equipment? provisions for keeping concrete fresh)
10. Will the placement method cause segregation or result in a non-uniform or uneven pour front?
11. Where does the Contractor propose to clean out trucks?

1-4.4 FINISHING METHOD (Standard Specification 514.17)

1. Finishing is the Contractor's responsibility under the end-result specification
2. Engineer's interest is in end results of:
   a) Smoothness
   b) Surface texture
   C) Surface crack intensity
   d) Physical properties of the concrete (plastic and final states) and cure.
3. The Engineer's responsibility is to establish grade control points unless construction staking is a contract item.
4. Special finishing Considerations:
   a) Lightweight concrete
   b) Adverse weather conditions
   C) Overlays

1-4.5 FINISHING CREW AND OPERATORS

Because the specifications do not require specific methods for deck finishing, the Contractor decides on the size and classification of the crew. However, the staffing of a deck pour

is an important area of discussion with the Contractor since the staffing effects the time required which affects concrete delivery, which may be delayed by traffic, etc., etc.

The degree of mechanization and the individual abilities of workmen will vary from job to job, but a recommended <u>average</u> crew size would include:

1 foreman who is in charge of the pour

2 laborers to rake ahead of the finishing machine

1 operator of the finishing machine

2 finishers for edging

1 broom and cure man

2 vibrator men

(a man to watch f/w on slab decks)

1-4.6 SPECIAL EQUIPMENT REQUIRED OR ADVISABLE

1. Cooling of concrete in hot weather
   a) Ice chipping machine at the plant or refrigerated water
   b) Fogging of the coarse aggregate stockpiles
   c) Open cover over the aggregate stockpiles
   d) Cool water supply at deck pour
   e) Fogging rebar and forms with cool water ahead of placement
2. Heating and protecting concrete in cold weather
   a) Heat water
   b) Heat coarse aggregate
   c) Cover stockpiles with black plastic (visqueen)

d) Protect completed deck as necessary to maintain temperature requirements. (Possible use of an external heat source.)

3. Back-up equipment for machinery that is critical (bidwell motors, hoses)

4. Possibility of rain?

Concrete deck placement should not be scheduled if inclement weather is impending. However, if there is a chance of rain, precautionary measures should be planned and appropriate materials should be available at the site at all times, such as:

(1) "visqueen"

(2) method of placing and removing visqueen

(3) a plan for getting rid of excess water on the low side

(4) building an emergency bulkhead

1-4.7 CURING EQUIPMENT (Standard Specifications 90-7)

1. Water supply at the site

2. Sufficient supply and pressure to produce a fog mist

3. Fog nozzle

4. Adequate means of applying curing compound

a) The conventional hand pump garden sprayer is not permitted for deck curing compound.

b) Contractor should prove (prior to concrete to concrete placement) the adequacy of his system for applying curing compound to the deck surface (power atomizing spray).

5. Make sure there are no leaks in the hose lines and that the hoses or other components will not drag across the surface.
6. Water for cure and use in deck construction is to conform to the requirements of the specifications.
7. Adequate supply -of moisture retaining coverings.
8. Positive means of keeping the different types of curing compound separate and identifiable.
9. Method of controlling water run-off from eroding falsework footings etc.

1-4.8 CONSTRUCTION DETAILS

Complete review of plans and specifications

1. Skew of abutments or bents versus skew of finishing machine (are you cutting out camber or vertical curve)
2. Is the bridge on a radius or are the edge of decks flared?
3. Superelevation and transitions
4. Cap steel related to deck steel
5. Openings through caps, deck and cap steel clearance
6. Hinges & Prestressing versus deck grades (Appendix 2)
7. Steel girder structures versus deck grades
8. P/S P/C "I" girders - Deck grades and thickness for uneven cambers
9. Variable span lengths - Non parallel abutments or bents
10. Stem and diaphragm stirrup hook location and resulting effect on deck steel placement
11. Specified openings and the effect on screed rail control for

deck grades

12. Longitudinal and transverse joints
13. Paving notch
14. Sidewalk and railing steel layout and height
15. Lane lines
16. Utilities, drains, manholes, etc.

1-4.9 CONSTRUCTION CONDITIONS AND SAFETY

1. Rails and kickboards at edge of deck, finishing and cure bridges and at other locations. (Construction Safety Orders-CSO 1620 & 1621).
2. Runways for foot traffic should not be less than 20 inches wide. (CSO 1624)
3. Proper runways with suitable handrails for access to superstructure when runway is 7.5 feet or more above grade.
4. Will placement or other equipment operate over the public or railway?
5. Will equipment interfere with overhead power or utility lines?
6. Will the public be adversely affected by delivery of concrete? Is there a possibility that placement will be interrupted?
7. Will strike off location and finishing machine length interfere with hand railing? Handrails should be kept in place. (Appendix 1)

SECTION 2

FORMS

2-1 CONSTRUCTION

2-1.1 TYPES AND CONSTRUCTION DETAILS (Standard Specification 51-1.05)

1. Stay-in-place or lost-deck forming

The most common stay in place forms are "lost deck forms" used for box girder construction. Although there are variations in forming methods and construction details, the general system of forming a typical box girder bridge is shown at the end of this section. Low velocity powder driven nails used to attach wood ledgers to concrete in lost deck forming systems have been recently approved for use. (Appendix 2)

Lost-deck- sheathing can be an exterior or interior grade plywood, or particle board (large chip). Metal is sometimes used for corner and fillet forms or as reinforcement. Metal and precast concrete stay-in place forms, some having a structural significance in the final product, have been permitted on some projects (usually detailed on the contract plans or by CCO).

2. Exposed surface forms

In deck construction this would include the soffit forms for slab bridges, the deck forms for T-beam, steel and precast concrete girder bridges and the deck slab overhang for all bridge types. Soffit forms for slab bridges being comprised of plywood sheeting attached directly to and supported by the falsework joists or stringers are usually considered an integral part of the falsework system. (Falsework Manual)

Deck slab forms for T-beam, steel and precast concrete girder bridges and overhangs are usually of conventional plywood and joist construction. The method of supporting the forms is usually dictated by the type of superstructure. Although there are deviations and refinements, the forming systems shown at the end of this section illustrate the basic methods used for each type.

2-1.2 STRUCTURAL ADEQUACY

The adequacy of all deck forming systems must be checked by stress analysis;[1] however,- form behavior cannot always be predicted or determined by analytical proof of its load carrying capacity. Theoretical deflections can be calculated if the physical properties and condition of the material are known, but in the case of "lost deck forms", the sheathing is frequently a material or grade of material whose modulus of elasticity is questionable particularly when the moisture content approaches the saturation point.[2] Consequently, deflections may and probably do exceed some arbitrary value commonly accepted and known as a "negligible amount".

There is also evidence that deflections and settlement of

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[1] Standard Specifications Section 51-1.06A "The support for form panels supporting concrete deck slabs and overhangs on girder bridges shall also be considered to be falseworks and designed as such."

[2] Standard Specifications Section 51-1.05 exempts forms which are completely enclosed from the requirements for formed surface deflections or undulations. Section 51-1.06A considers only joists for deck slabs and overhangs as falsework. Refer to (1)

the forms is not instantaneous but continues, in some cases, during the initial set period of the concrete.

What effect, if any, concrete shrinkage has on prolonged form deflection and settlement is debatable. The important point is that deflection and settlement can and do occur after concrete placement. Normally, yielding of the forms is not structurally detrimental to the deck slab as long as it does not continue after the initial set period. Attaining a uniform riding surface may be impaired if the concrete subsides after form deflection and settlement.

The joists supporting the deck slabs of steel and precast concrete girder bridges and deck overhangs are considered as falsework and the sheathing deflections or undulations between joists, constituting forms for exposed concrete surfaces, are covered by the Standard Specifications.

The structural adequacy and deflection of timber joists can be determined by stress analysis. Patented joists should be load tested to determine the dead load deflection for the actual condition of loading if the manufacturer's loading data is in question.

Normally patented or timber joists for steel and precast concrete girder bridges are supported by ledgers which are either underpinned by posts to the bottom flanges of the girders or suspended from the girders by hangers. Custom or homemade hangers made of steel bar stock bent to form a "U" which fits over the top of the girders should only be used after they have

been satisfactorily load tested.

This method of fabrication induces high stress points at the bends, and use of this type of hanger has resulted in total failure under relatively light loads.

Many types of patented hangers are available for deck forming systems on either steel or concrete girder bridges. The safe working loads recommended by most manufacturers are based on and are subject to certain conditions and any modification of the units themselves or deviation from their intended use will effect their capacity.

One common stipulation is that the hanger bolts be either flush with or a specified distance from the edges of the girder flange. The rated capacity of some hangers may also depend on whether they are used on steel or concrete girders. Hangers must be investigated for potential uplift and subsequent rotation due to unbalanced loading.

Restraint may be provided by the forming system or the hangers may be welded to the girders subject to the conditional requirements set forth in the Standard Specifications.[3] On conventional steel girder bridges, restraint is provided by the extension of the haunch or deck forms under the girder flanges.

Overhang forms for box girder, T-beam and slab bridges are

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[3] Standard Specifications Section 50-1.05 Whenever electric welding is performed on or near members containing prestressing steel, the welding ground shall be attached directly to the steel being welded." Section 55-3.17 "Brackets, clips, or other material shall not be welded to the flanges of girders, unless shown on the working drawings specified in Section 55-1.02, "Drawings", and approved by the Engineer.

usually supported directly by the falsework system by underpinning with posts to the soffit forms.

On steel and precast concrete girder bridges the forms are supported by overhang brackets or jacks attached to the exterior girders.[4] Either system is considered falsework and analyzed as such.

Deflection and settlement must be minimal for appearance and satisfactory grade control when screeds are located in the overhang area. Determination of deflection and settlement is difficult, particularly when bracket or jacks with cantilevered joists or outriggers are used. A load test would be justified if form behavior and subsequent deflection and settlement cannot be. ascertained by stress analysis or precedent.

Patented overhang brackets and jacks, such as those manufactured by Superior Concrete Accessories, Inc., Waco Scaffold and Shoring Company and Burke Concrete Accessories, Inc., are in general use. Design information, including deflection data, for these units is available from the manufacturer and should be requested from the Contractor to check these products for contract compliance.

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[4] Standard Specification Section 55-1.05 "Falsework and forms supporting the concrete work on steel structures shall be constructed so that any loads applied to girder webs shall be applied within 6 inches of a flange or stiffener and shall be distributed in a manner that will not produce local distortion of the web. Temporary ties and struts shall be provided as necessary to resist lateral loads applied to the girder flanges and to prevent appreciable relative vertical movement between the edge of deck form and the adjacent steel girder."

2-1.3 VERTICAL ALIGNMENT AND GRADING

This is another area where good preconstruction planning will pay off. A discussion with the Contractor should determine the proposed framing system, types of material to be used, whether screeds will be located on the edge of deck forms, and how the forms will be adjusted. You should also discuss your grading requirements and procedures at this time.

Control for lost deck forms in box girder bridges is usually established the next working day after the soffit and stem pour. Deck grades should not be established in the field until adequate safety features have been installed.

Providing a cut from the top of a rebar dowel cast in the girders at predetermined points will give adequate control for deck forming. If cuts are given by the Engineer, all cuts should be to top of deck and then let the Contractor determine the elevations of form supports.

Grades should be provided at all breaks in grade and at intervals not closer than 8 feet longitudinally and 24 feet transversely to the centerline of bridge. The amount of vertical curve and camber must be considered when determining these intervals, so that string-lining between these points will not cut out camber or vertical curve. Refer to the Falsework Manual for more discussion on camber.

Rightafter deck grades have been established; a check should be made at random locations to see how these grades correlate with what is already poured.

Do the stirrup heights fit? (The length of the stirrup should have been checked before the stem pour). Is the structural depth correct? Now is the time to consider any necessary grade adjustments, not when you find out that the deck steel isn't quite right after it has been placed.

Grade for the deck overhangs will require extra attention since these grades. produce one of the more obvious lines of the structure. First, all grades should be picked at the locations where the grade adjustment is to be made. This means field measuring the locations of the overhang supports *and plotting these on the 4-scale drawing or edge of deck profile line. Before grading the overhangs, enough load should be on the forms to tighten up the joints. Usually this is accomplished when the major portion of the deck rebar is in place.

Many different schemes have been proposed for grading overhangs (i.e., grade every other support, grade it all l/4 inch low the first time then bring it up, etc.). Until you have proven the Contractor's system on your job, you should be prepared to check each location@ Your final check is the "eye ball, but make sure all final wedging and adjustments at the face of girders have been completed.

See Section 4 for a further discussion on grading overhangs.

2-1.4 HORIZONTAL ALIGNMENT

The horizontal alignment of the structure will generally dictate the tools necessary to provide this line. Before the

horizontal line is set on the edge of deck forms, the grade of these forms must be close. This rough grading can usually be accomplished by the Contractor with the use of templates and the lost deck grade dowels.

Straight lines are usually established with a transit and/or string line. Curved lines can be established with a transit and standard chord offset procedures using the centerline of abutments and bents as control points. On complex projects it would be wise to get District Surveys involved.

No matter what method of establishing line is used, always check the following two items:

1) check into known points at each end of the structure, and
2) check the overall width at several locations throughout the length of the-structure.

2-2 INSPECTION

(See Appendix 2 for Checklist)

2-2.1 STRUCTURAL ADEQUACY, MORTAR TIGHTNESS AND CONDITION OF SURFACE

Obviously, the structural adequacy of the forming system, as with falsework, is not determined solely on the basis of stress analysis. Inspection of the forms isnecessary to ensure their stability.

The inspection should preferably be made by personnel who are thoroughly familiar with the forming Plans (i.e., the person who checked the falsework or at least reviewed it).

The importance of mortar tightness and surface condition is apparent for the forms of exposed concrete surfaces where appearance is a factor. Because the lost deck is not visible, the subject of mortar tightness is often dismissed. Loss of mortar or grout through holes or cracks in the forms will not only affect the appearance of the concrete but also its structural quality. Tin is often used to patch holes or cracks and spray foam is useful especially around deck drains etc., as. long as there is solid backing. Note that building paper is not to be used to patch lost deck forms.

2-2.2 -DEPTH OF STRUCTURAL SECTIONS

Deck slab thickness, including the effective depth(s) and coverage of reinforcing steel, must be checked to insure structural adequacy. This is usually done by measuring from a string line pulled between the screeds or bulkheads prior to the finishing machine adjustment, and from the strike off or rollers of the finishing machine during the adjustment of the machine. The depths should again be checked during the pour by stabbing the plastic concrete following strike off. (A snap tie with the correct deck thickness marked on it is a good tool for this).

Effective depth and clearance of reinforcement is discussed in Section 3.

2-2.3 HINGES, CONSTRUCTION JOINTS, PAVING NOTCHES AND APPROACH SLABS

Forms or bulkheads for hinges, expansion and construction joints are set approximately 1/2 inch low to clear the rollers when a finishing machine is used, allowing it to "make" the grade at the joint. After final floating, a filler strip or edger board is attached to the form for dressing and edging the joint, or else the edge is sawcut later.

On multi-frame bridges connected by-a hinge, it is important to adjust grades so that the final surfaces match on either side of the hinge. Memo to Designers #11-34 Hinge Curl, is included in Appendix 2. After the first deck is poured it should be profiled and monitored, and from this information the grades of the second deck can be adjusted to match the first. Don't forget to include settlement in the second deck grades when trying to match the first. See the Inspection Check List in Appendix 2 for hinge monitoring procedures.

The top section of abutment backwall, formed between the expansion joint and paving notch, should not be constructed until the deck concrete is placed. The deck surface is then used to establish the finished plane for this section. Proposed approach slab grades (as well as entire bridge) on the 4-scale should be checked with the road "grid grades" when checking the 4-scale drawings. After the bridge deck is poured, the ends should be profiled so that adjustments can be made in the approach slab grades if necessary. Consult with District personnel so that both parties are aware of any proposed grade changes.

2-2.4 Overhangs

The importance of stability of deck overhang forming systems for aesthetic reasons and deck grade control was noted earlier. To avoid repetition, their inspection is included in Section 4 and in the Inspection Check List in Appendix 2.

2-2.5 Miscellaneous Items - Drains, conduit; etc.

All drains, conduit, etc., should be shown and identified on the 4-scale layout and grade sheet for each structure. It is a good idea to attach road plans and standard plans showing pertinent drainage, electrical and sign details to the bridge plans for reference.

Miscellaneous items must be checked for proper location and be adequately secured to prevent movement during concrete placement and finishing operations. Drains should be set low enough in accordance with the plans, and also the plane of the grate must be set parallel to the deck surface with the inlet properly sealed to prevent entrance of concrete and other foreign material.

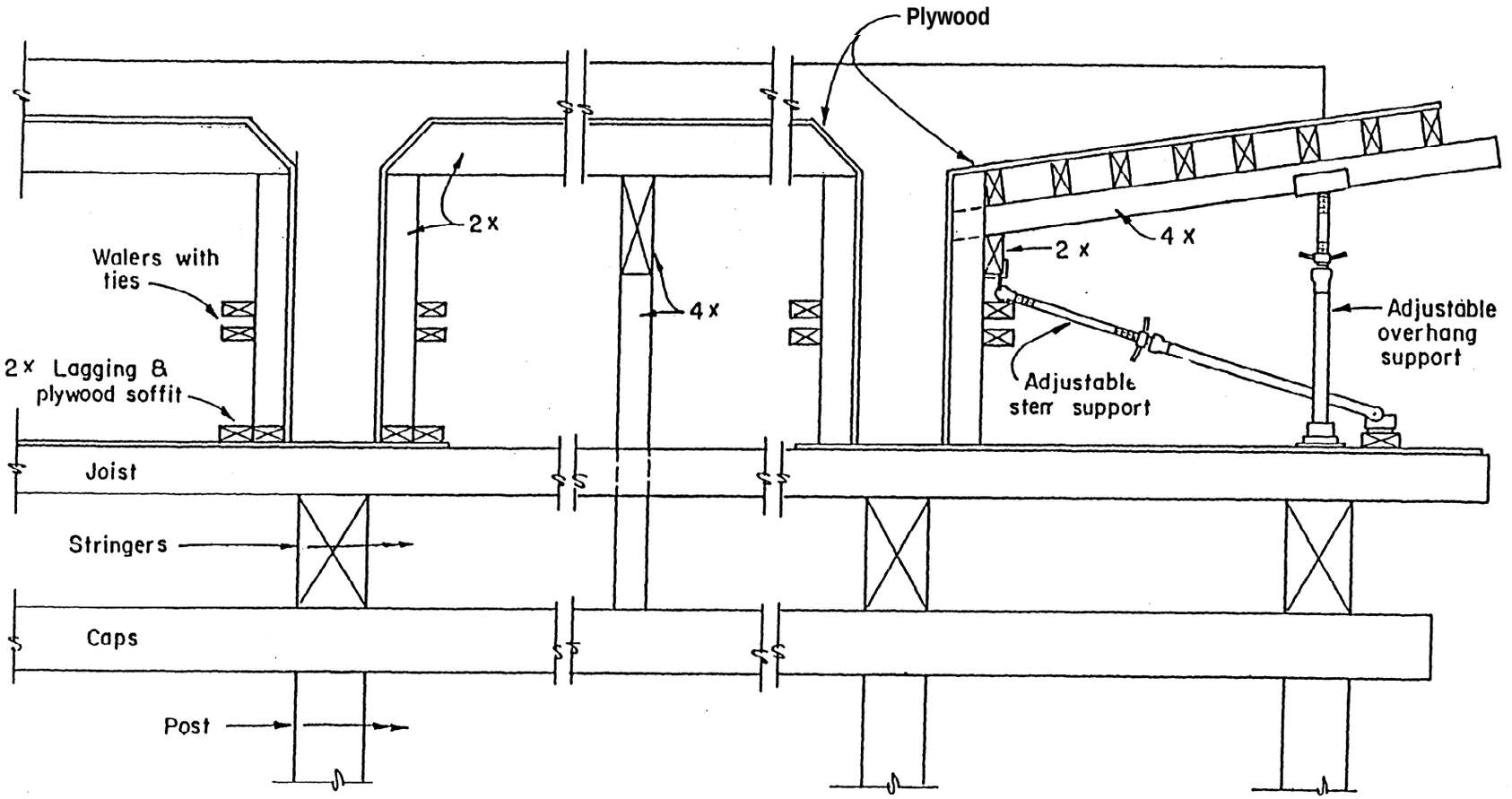
2-2.6 EXPANSION JOINTS (Standard Specification 51-1.12)

Joints to be sealed with Type A & B seals are sawcut at locations shown on the contract plans and to the dimensions determined in accordance with Bridge Records and Procedures 135-2.0.

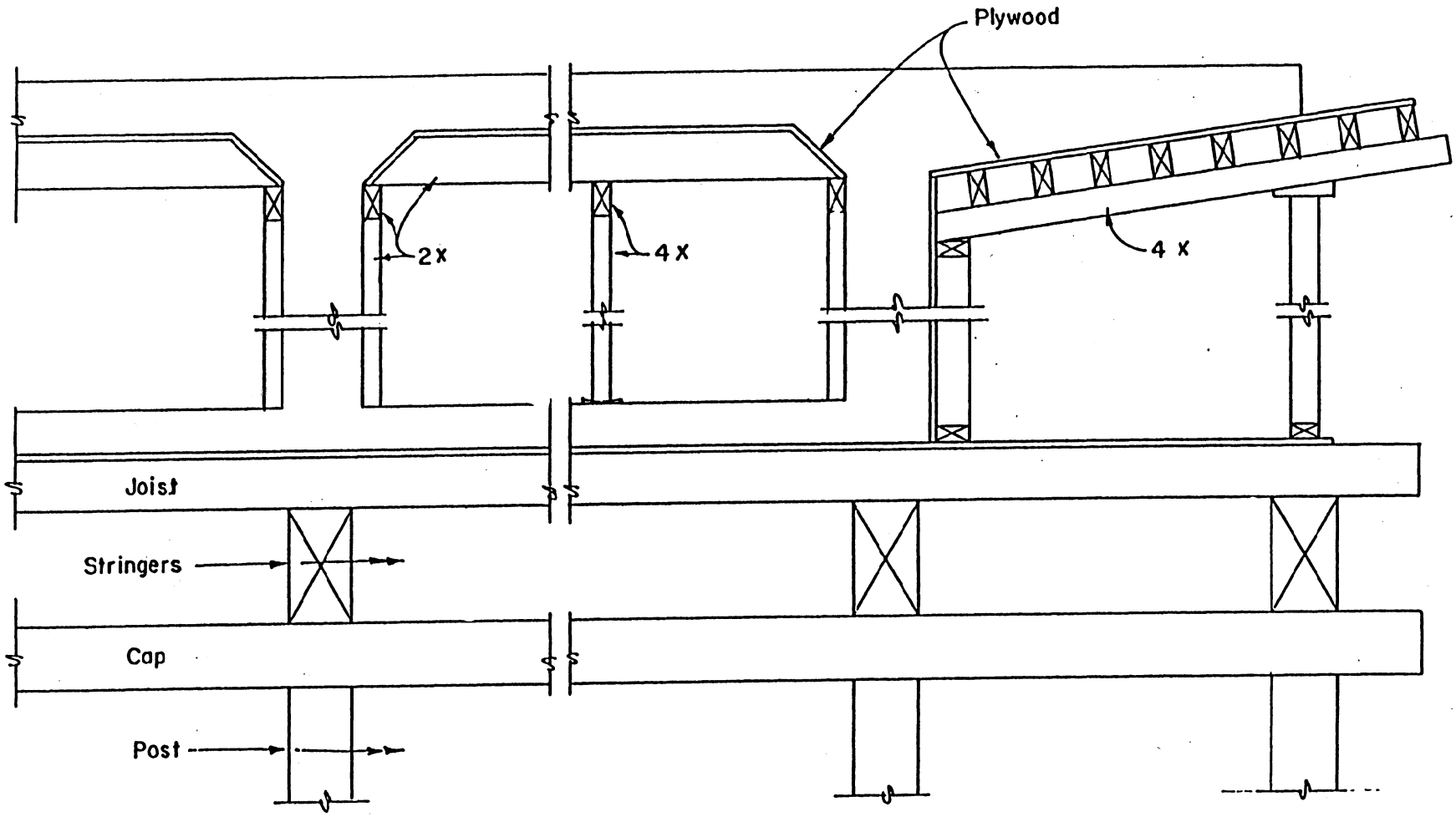
Joint seal assemblies are placed in blockouts between the deck and approach slab or in hinge sections, then concrete is deposited around the assembly. Shop drawings for joint seal assemblies should be submitted early for approval so that the required block-outs are formed to the correct dimensions, and the reinforcingsteel can be checked for proper clearance at these locations. These assemblies must be set to exact grade and carefully checked for their entire length. The assembly is sometimes warped or bent during fabrication by welding or the galvanizing process, in which case it should be straightened by reworking. Careful inspection should be given to skewed joints so that the assembly will fit properly at the barrier rail. See Bridge Construction Records and Procedures 135-2.0 for more discussion on joint seal assemblies.

Grinding should always be done prior to joint seal installation to avoid any damage to the joint seal or assembly. The Standard Specifications do not require deck grinding to be completed prior to the installation of Type A or B joint seals as it does for joint seal assemblies, but unless deck grinding is performed first you are only guessing at the correct depth of installation. The Contractor is responsible for any damage to the joint seal assembly and is responsible for constructing the completed roadway surface true to the required grade and cross section, including smoothness across the joint seal or assembly. Placing asphalt or concrete over a sand bed in the joint seal assembly block-outs prior to deck grinding is one method of achieving a smooth deck before installing the joint seal assembly.

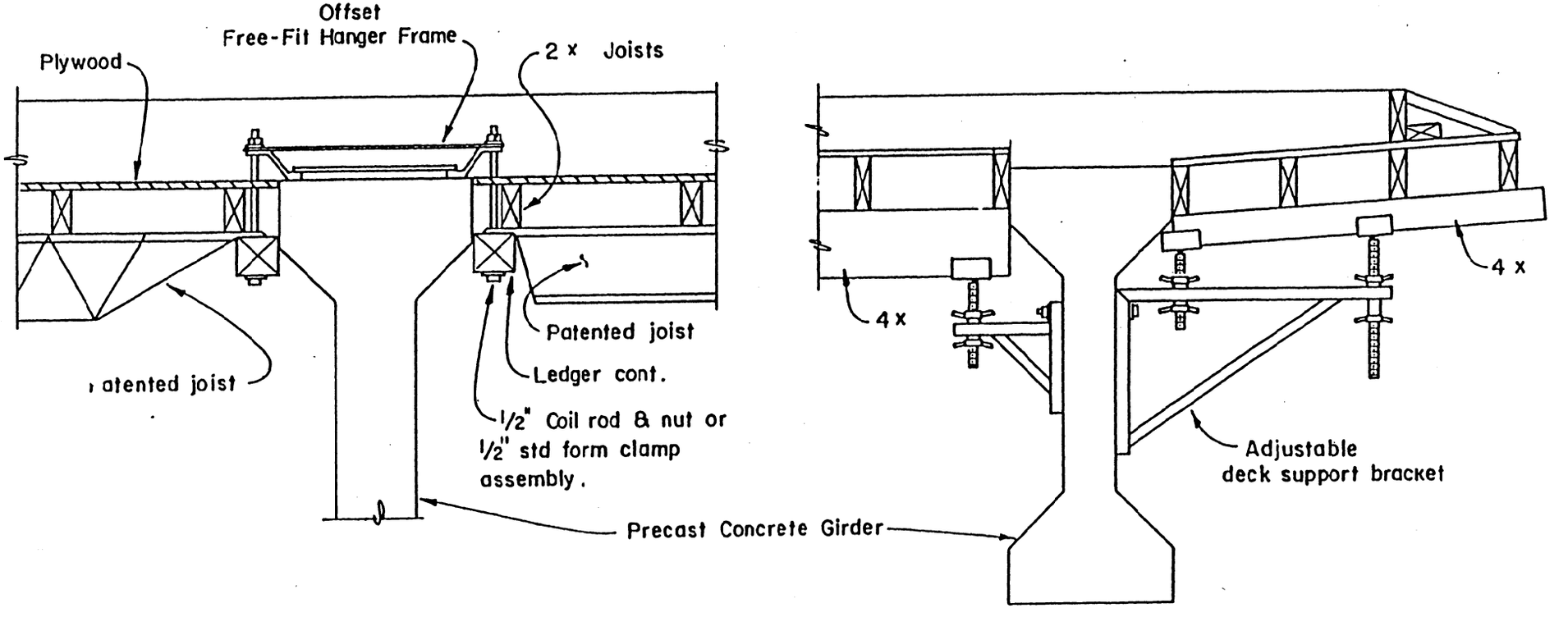
T-BEAM DECK AND OVERHANG FALSEWORK DETAILS



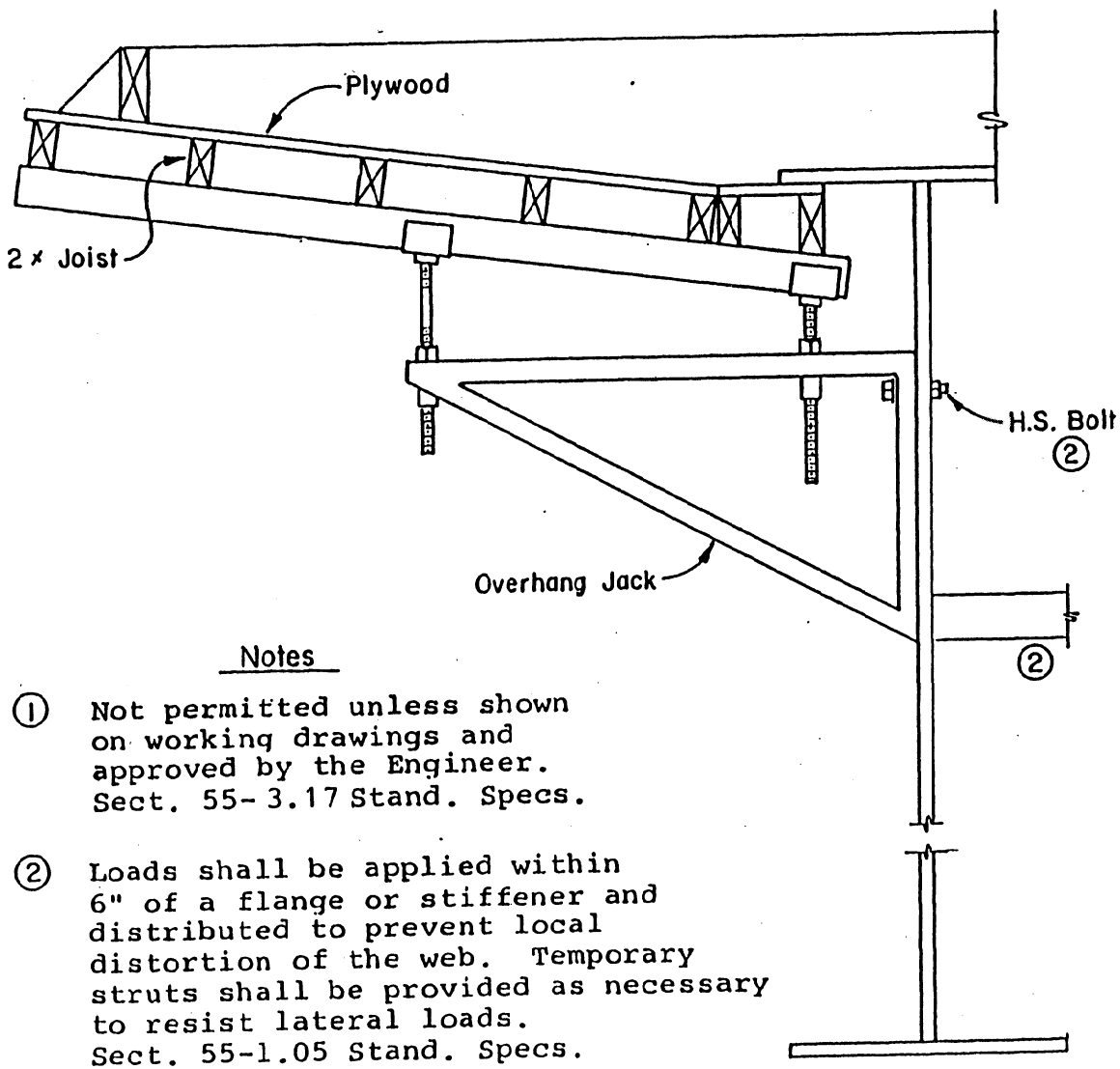
BOX GIRDER LOST DECK FORMS AND OVERHANG FALSEWORK DETAILS

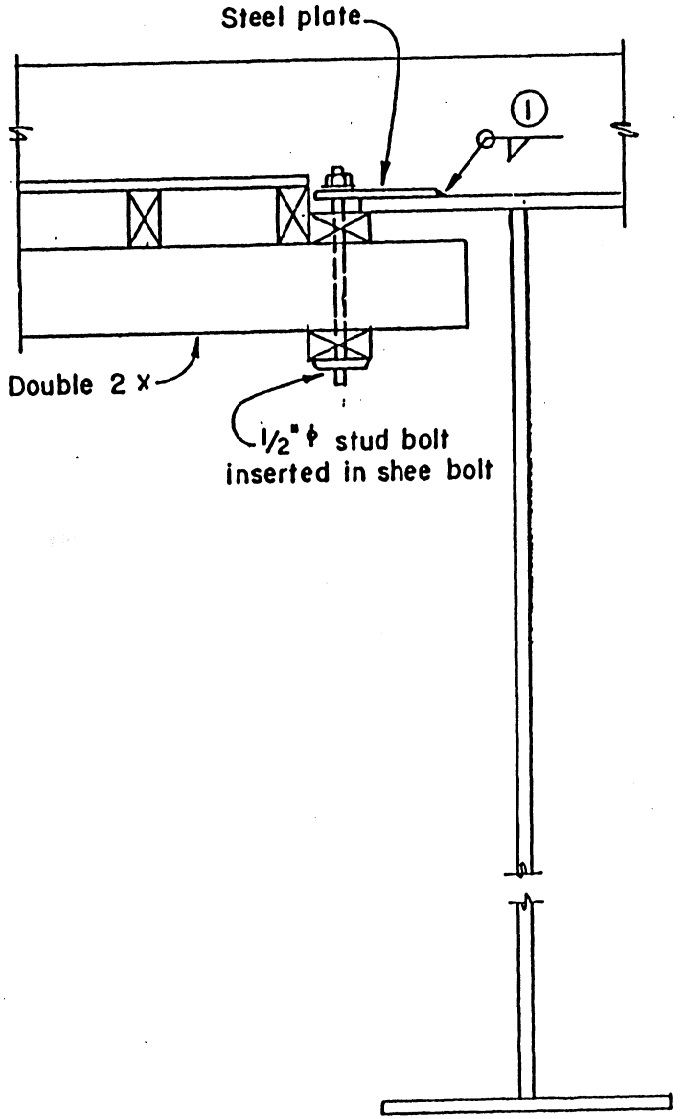


PRECAST CONCRETE GIRDER DECK AND OVERHANG FALSEWORK DETAILS



STEEL GIRDER FALSEWORK DETAILS



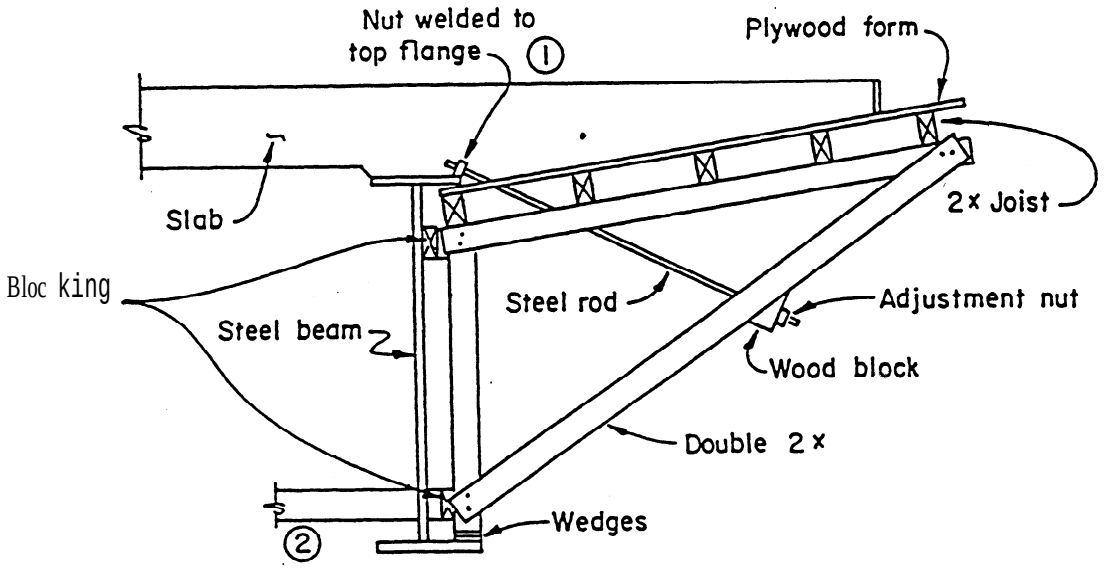


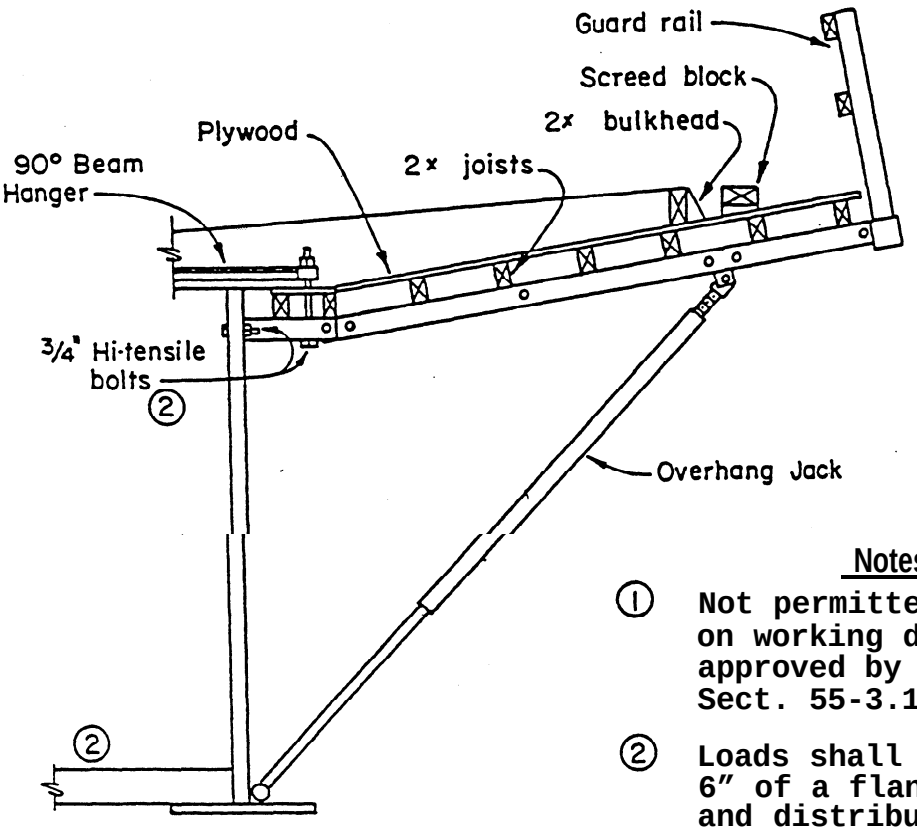
Notes

① Not permitted unless shown on working drawings and approved by the Engineer. Sect. 55-3.17 Stand. Specs.

② Loads shall be applied within 6" of a flange or stiffener and distributed to prevent local distortion of the web. Temporary struts shall be provided as necessary to resist lateral loads. Sect. 55-1.05 Stand. Specs.

DECK OVERHANG FALSEWORK DETAILS





Notes

① Not permitted unless shown on working drawings and approved by the Engineer. Sect. 55-3.17 Stand. Specs.

② Loads shall be applied within 6″ of a flange or stiffener and distributed to prevent local distortion of the web Temporary struts shall be provided as necessary to resist lateral loads. Sect. 55-1.05 Stand. Specs.

SECTION 3

REINFORCING STEEL

3-1 GENERAL SPECIFICATION REVIEW FOR DECK REINFORCING

Section 52-1.02A of the Standard Specifications require that all reinforcing for bridges conform to the specifications of ASTM Designation: A 615, Grade 60 or low alloy steel deformed bars conforming to ASTM Designation: A 706. Welded wire fabric may be used in lieu of uncoated reinforcing for overlays only.

If the plans show that the deck reinforcing is epoxy coated, then all the requirements of Section 5201.02A must be met plus the epoxy coating must meet the requirements of Section 5201.02B of the Standard Specifications.

3-1.1 STANDARD DETAILS

These items will be included in the Standard Plans. Check page B0-5 for transverse and longitudinal reinforcing spacing requirements, location of deck construction joints and deck reinforcing placement notes. If there are Access Openings in the deck, check page B7-11 for reinforcing details. For placement of deck drains and barrier rail reinforcing details, see pages B11-53 and B11-54.

Other information such as hook and bend length and radius are in the CONSTRUCTION RECORDS AND PROCEDURES MANUAL, VOLUME 2, CHAPTER 165. The information conforms to the requirements of the ACI code for hooks and bends.

3-1.2 DETAILING AND FABRICATION

In order to reduce the probability of errors due to detailing, the deck contours (4-scales) should be made available to the prime contractor for the reinforcing steel fabricator's use. Special details of the deck reinforcing and any change orders affecting reinforcement should be brought to the contractor's attention.

Errors in detailing or fabrication are more likely to occur on bridges with the following characteristics:

* varying girder spacing
* varying deck thickness
* large skew
* varying skew
* wide curved bridges with small radius of curvature
* widenings and future widenings

Typical errors to watch out for on these bridges include incorrect reinforcing in the corners, truss bars not centered over the girders, incorrect termination location (endo), omission of bars at the overhangs at the bent cap, etc. Also omission of reinforcing shown on the Standard Details, especially around barrier rail mounted utilities is not uncommon.

Fabrication is seldom a problem unless the standard industry practices for fabrication tolerances are ignored.

3-2 INSPECTION

3-2.1 PLACEMENT

Reinforcing must be placed as shown on the contract plans, the Standard Plans, or any applicable change orders, Accurate reinforcing steel placement is very important. Included in the Appendix is a memo with calculations showing that the moment carrying capacity of a bridge deck varies greatly when the effective depth of the section is only slightly changed.

Correct placement is covered in Section 52-1.07 of the Standard Specifications. For specific problems in placement not covered in the Standard Specifications, check with the designer to determine the tolerances or variations in placement that are allowable.

During field inspection of the reinforcing, check the markings on the bars. The markings identify the bar size, grade and steel mill. A complete guide to reading the markings on the bars is in Appendix 3 of this manual and in Chapter 165 of the Construction Records and Procedures manual.

Periodic and timely inspections are strongly recommended during bar placement in order to detect and correct errors early.

3-2.2 CLEARANCES

Correctly placed deck reinforcing that provides the planned clearance or cover for the bars is extremely important. Toolittle cover , especially in a corrosive environment, will not adequately

protect reinforcing from rusting and can dramatically shorten the life of the deck. Spalling of deck concrete, barrier rail or edge of deck concrete caused by corroding reinforcing with inadequate cover creates unsightly stains and costly maintenance problems. Be sure and check that the minimum clearance to the top deck, the boundaries and the endo is 2 inches. In marine environments or in areas where de-icing chemicals are used, the planned cover will probably be greater than the minimum 2 inches. The required minimum clearance will be shown on the plans.

3-2.3 SPLICES

Lap splicing, the most common method of splicing deck bars, is covered in section 52-1.08A of the Standard Specifications. For the most common sizes of Grade 60 deck reinforcing, the minimum lap splice length is 45 bar diameters. Unless shown otherwise shown on the plans, the splices in adjacent bars shall be staggered. The minimum distance between the staggered splices shall be 45 diameters or one splice length. The American Concrete Institute will permit shorter distance between staggered splices depending upon the level of stress in the bars. If the contractor's bar splicing plan shows the deck bar splices staggered at less than the. minimum distance, check with the designer to verify the proposed spacing. During your inspection, make sure the splices are securely tied and will not move during the deck pour. For widenings and closure pours, check the plans carefully for the type of splice required. Refer to Section 52-1.08 B thru E of the

Standard Specifications and Bridge Construction Memo 165-7.0 located in the Bridge Construction Records and Procedures for the correct procedures to follow for welded or mechanically spliced reinforcing.

3-2.4 BLOCKING AND TYING

All deck reinforcing must be securely tied and blocked up off the lost deck forms to prevent any movement during placement of the deck concrete. The Standard Specifications do not permit the use of wooden, plastic or aluminum supports. If ferrous metal chairs are used, they must also have at least 1" of clearance. The plastic coatings on the chair feet are not considered to be effective and are not counted to be part of the 1" clearance. The Specifications also do not permit placing reinforcing into wet concrete during the pour.

Between the girders, "ducked" or buried bars are shown on the plans to support the bottom mat. They are #4 bars spaced at about 2 ft on center. Truss bars and concrete blocks support the top mat. Truss bars must be securely tied to prevent any rotation. If they rotate, the top mat will be out of position and a reduction in deck strength will be the result. If truss bars are not used, the contractor will use concrete spacer blocks to support the top mat. At or near the girders, some contractors will attempt to support the top deck mat on the stirrup tails. This can be aneffective method of support provided that the tails are correctly positioned to do this task and the bars are securely tied to the tails to

prevent movement before or during the pour.

In general, mats of reinforcing steel must be tied so that individual bars cannot move during the pour. The American Concrete Institute recommends that bars be tied at every other intersection. This is adequate in most cases. At corners, over bent caps and other special locations, more frequent tying may be necessary. See Section 52-1.07 of the Standard Specifications for tying and other placement requirements.

SECTION 4

GRADE CONTROL, SCREEDS AND BULKHEADS

4-l COMPUTATIONS

4-1.1 4-SCALE CONTOURS

We refer to bridge deck contour plots that are drawn to a scale of 1 inch equaling 4 feet as '4-scales'. In most cases 4-scale contour plots are available from Bridge Design in Sacramento. Bridge Construction Memo 2-4.0 outlines the procedure to be used for obtaining the 4-scale contour plots. (See Appendix 4).

After receiving the 4-scale contours, a detailed check of the plan dimensions and grades is required and any detail errors and conflicting dimensions must be corrected before making copies of the deck contour plots available to the Contractor. Each bridge 4-scale sheet should be checked against the final finish grade profiles and the superelevation diagrams shown in the grid grade book. Also, edge of deck profiles should be drawn in order to check for dips or humps caused by superelevation transitions, alignment tapers, and other anomalies. This profile should extend beyond the bridge paving notches and include retaining walls, wingwalls, and bridge approach rail as well as a section of roadway. Sections of the 4-scale may require revision in order to avoid possible grade problems.

4-1.2 PROFILES

4-1.2.1 WIDENINGS

Typically, widened decks are constructed to match both an existing bridge deck as well as theoretical grades generated for the outside edge of the widened deck. Some features of existing decks which may cause problems are:

(1) too much camber;

(2) too little camber;

(3) bumps not corrected on the original contract;

(4) rough surfaces and other defects under removed curbs and rails.

Existing decks may require grinding or overlays to correct these problems.

Sometimes medians are widened so that the top deck must match two existing bridge decks., in lieu of one, and also a theoretical centerline profile. This type of widening may provide situations where the existing bridge deck profiles are in conflict with each other as well as with the theoretical centerline profile. In order to satisfy this condition, the profiles will need to be adjusted, the deck cross slopes may need to be varied, or other solutions sought. It should be noted that closure pours between new left and right structures pose similar challenges.

Edge profiles for the existing decks and roadways are sometimes included in the contract plans. These should be re-shot and checked. Profiles should be developed as early as

possible in order to determine if remedial work is necessary. It is important that grade problems are identified and solutions planned early in construction.

4-1.2.2 NEW CONSTRUCTION

On long ramp structures, viaducts, and any structure requiring multiple pours, potential bump problems exist at each transverse bulkhead, expansion joint or hinge. With proper profiling and grade control of the adjacent work, the edge of deck grades can be constructed without grade or slope discontinuities.

Extra effort is required when a second deck pour must "come into" or match an existing deck at a hinge or a transverse construction joint. It should be recognized that care at the end of the first-pour is essential in obtaining a satisfactory joint. It is much easier to match something that is right than to try and compensate for irregularities. After the first deck pour, the deck should be cross sectioned and profiled. A grid of points, preferably at even stations and offsets, should be established on the first day after the pour. Elevations should be shot at this time and monitored until grades are established for the second deck pour. These elevation points are used to check for the possibility of long-term falsework settlement as well as monitoring any movement of prestress hinges. In a few cases, soffit grades as well as "lost deck" and screed grades will require adjustment. Profiles of the first deck should be

extended onto the second deck profiles and compared with theoretical values. Adjustments, if any, are then made to the second deck pour grades.

It is very important to maintain exact stationing and bench datum on steeply cross sloped decks, or decks with sharp vertical curves or with steep profile grades. The Engineer should mark stationing in the newly finished edge of deck or develop some other method to assure correct stationing for the next segment. Edge of deck points should also be laid out and shot the first day after the pour.

4-1.3 DEAD LOAD DEFLECTION; CAMBER AND SETTLEMENT

Camber for the decks of conventionally reinforced concrete box girder, T-beam and slab bridges is the algebraic summation of the anticipated long term deflection due to creep of the concrete and the initial dead load deflection. Experience has -shown that for box girder and T-beam structures, essentially all of the falsework deflection occurs when the girders are poured. This is true even for post tensioned bridges with long falsework spans. (Studies indicate that for a post tensioned box girder bridge, 50% or less of the theoretical deflection due to the deck slab dead load is realized when the deck is poured.) Therefore, the deck camber for conventional reinforced or prestressed box girder and T-beam structures would normally not include falsework deflection.

Deck camber for prestressed "I" girder bridges is dependent on the time that has elapsed between stressing the girders and placing the deck. Because a significant portion of the dead load is not applied to the girders until the deck is placed, the prestressed "I" girders tend to creep upwards. In order to try and compensate for this upward movement of the girders, Bridge Design has started including camber values based on an anticipated elapsed time between stressing girders and placing the deck (see Appendix 4). The designer should be notified and the camber diagrams modified if this anticipated elapsed time is going to be changed.

Deck camber for steel girder bridges would include the initial deflection of the girder(s) due to the dead load of the deck, do not include the deflection caused by the weight of the girder(s). Plus in the case of composite design, a residual amount to compensate for the additional deflection due to shrinkage of the slab.

The residual camber shown on the plans for concrete structures should be examined and unreasonable amounts questioned.

Long term deflection of conventionally reinforced concrete bridges continues over a period of about 4 years. Approximately 25% of the total deflection is realized immediately after the falsework is removed. The initial deflection as well as the total deflection can be reduced by delaying falsework removal. Consequently, on widenings, the plans or Special Provisions

frequently require falsework support for a longer period of time. In order to further reduce the grade differential between widened and existing decks, the specifications may also require that a minimum period of time must elapse between the time the falsework is released and the closure pour is made. (See Appendix 4). Typically, the contract plans show only one camber diagram for each bridge widening. However, after the closure pour is made, the widening is usually restricted from deflecting the same as an independent bridge would. Depending on the amount of camber and the time of the closure pour, the total anticipated deflection for the section of the widening located next to the existing bridge may never be realized. Therefore, the amount of camber for this section of the widening may need to be adjusted in order to reduce possible grade differentials that could develop between the widened and existing decks.

As with falsework members, the dead load deflection of steel girder bridges must be checked. Before steel girder fabrication, the effect of built-in camber should be checked using the 4-scale layouts. Deck forms and screeds, for steel girder bridges, are graded by using fills from the girder flanges. These are determined by comparing the profiles of the girders with those of the finished deck, including the anticipated deflection, along the girder line. In connection with steel girder profiles, there are three important things to remember:

(1) <u>Safety, do not perform any work of any kind without adequate safety devices</u>, (i.e., a safety belt attached

to a cable, a safety rail running the length of the girder, safety nets, etc.);

(2) grade points must be accurately laid out and referenced to the center lines of bearing;

(3) level circuits should only be run early in the morning when temperature variation is minimal and while the girder temperature is constant or stable. Do not go back later in the day and attempt to check elevations! These elevations may not even be the same the next morning!

Settlement, insofar as bridge decks are concerned, can occur in the falsework and/or the forming system. Normally bridge deck settlement results from form take-up, assuming that falsework settlement has terminated or has been stabilized. Exceptions would include the following: slab bridges where settlement is compensated for by screed adjustment during concrete placement operations, post tensioned bridges where falsework settlement may occur due to prestressing forces applied after the deck is poured, and deck forming systems such as overhangs designated as falsework.

Falsework settlement is covered in both the Standard Specifications and the Falsework Manual. However, it should be noted that some falsework settlement due to take-up in forms is normal; but, the quality of workmanship must be such "that the falsework will support the loads imposed on it without excessive

settlement or take-up beyond that shown on the falsework drawings."

4-1.4 FIELD NOTES

With current staffing levels, an organized and systematic approach towards bridge deck construction is more important than it has ever been in the past. Proper field book entries are essential in order to provide the required bridge deck elevations in an expeditious manner. Entries for box girder deck construction should include the following:

Lost deck elevations - Typically, saw cuts are placed on girder stirrups or on pipes (or rebar) cast in the girder stems so as to provide the Contractor with top deck elevation control points. The Standard Specifications state that "The locations of such elevation control points will not be closer together than approximately 8 feet longitudinally and 24 feet transversely to the centerline of bridge." The spacing of the deck elevation contol points should be close enough to allow the use of a string line to check the deck. Deck elevation control points can be grade marks a constant distance below finished deck grade, grade marks at finished grade, or fills to finished deck grade from preset points.

Normally a small error of closure exists between field measured points and layout scaled dimensions. This is true in soffit grades as well as lost deck grades. If these errors are not adjusted and discrepancies are allowed to accumulate, the

camber diagrams will not be correctly related to the substructure, and wingwall and column grades. will not match the superstructure grades.

One acceptable method for adjusting errors is to assume that bents, piers, and abutments are in the correct location and prorate the error out within the spans. Layout the points on the 4-scale as measured in the field and shrink or expand the scale to make field measurements match the layout. Stations on soffits and soffit grade points should be similarly adjusted.

Overhangs - When the overhang is formed after the girder stem pour, the Contractor should use the lost deck grades to establish grade for the inside potion of the overhang located next to the exterior girder.

Once the locations of the overhang adjustment points can be determined, the overhang grades should be generated. Typically, these grades are taken directly from the edge of deck profiles that were drawn to check the 4-scale contours. Depending on the forming system used, additional camber may need to be added to the overhang grades.

The bench mark used for grading the overhang should always be checked against that used for shooting lost deck grades.

Screeds - Typically, the overhang grades are used to shoot the screed. Depending on the forming system used, additional camber may need to be added to the screed grades to compensate for deflection due to the bidwell.

Bulkheads - Finish deck grades at bulkheads and paving notches are established by the finishing equipment.

Note that all grades used for deck construction should be tied together and that grades should always be checked back to previously shot grades for continuity. Lost deck grades should be spot checked when shooting overhang grades to check for long term falsework settlement. Stationing and level datum must be coordinated between adjacent pours in order to provide a matching deck surface. Location and accessibility to bench marks require foresight to prevent the loss of key elevation points.

4-2 GRADING AND INSPECTION

4-2.1 CONTRACT SURVEYING

Although the use ofcontract surveying has been discontinued/phased out, this was an important part of our operations and will be briefly addressed.

Contract surveying was incorporated into some projects as a way of reducing the amount of staffing needed, and to make the Contractor responsible for providing the line and grade required to complete the job. Bridge construction personnel were expected to perform enough surveying to assure that each structure was being built to the lines and grades specified. Typically, the Structure Representative checked almost all of the Contractor's survey points at the beginning of each job. But as the project progressed, the Structure Representative would adjust the amount

of checking to reflect the level of confidence developed towards the Contractor's Surveyors.

4-2.2 LEVELS AND TRANSITS

A systematic schedule for maintaining, cleaning and pegging levels should be established on every project. It should be posted and kept up to date. Instruments can and do get out of adjustment - handle them with care! Check level legs for stability as they can get loose and wobbly at the leg tips and at the connection to the plate. Check lenker rods for loose sole plates and sloppy operation.

4-2.2 OVERHANGS

Grading and inspecting the overhang bulkheads and the overhang supports are two of the most important items of deck construction. The contractor's plans should be checked for structural adequacy and details that may result in uneven settlement. Extra attention should be given to connections and bearing areas. All joints must be solid in order to prevent differential deflections due to the weight of the finishing machine. Look for potential stability problems such as a tipping overhang due to loads being concentrated along the outside section of the overhang.

If the overhang is constructed at the same time as the girder stem forms, precautions must be taken to keep the overhang clean. Plastic sheeting, "lost deck" plywood covering, and

building paper have been used in the past as ways to protect the overhang forms. If the overhang is built after the girder stem pour, check the grade at the exterior girder before the deck reinforcing steel is placed. Always check the overhang lumber for defects as the overhang is being constructed.

If overhang jacks are used, make sure that they/are installed per the manufacturer's recommendations. Jacks should not be extended too far, vertical legs and screw adjustments should be plumb, etc. On steel girder bridges the connection to the web should not cause web dimpling and bracing may be required to prevent girder rotation. Check lumber for defects and watch for tipped joists etc.

The overhang should always be rough graded before the edge of deck line is established:. Otherwise, the edge of deck line may shift if the overhang grades are adjusted an appreciable amount.

The -method and manpower requirements for grading the overhang should be worked out with the contractor in advance. Rodmen and carpenters must be made aware of the importance of form continuity and of the importance of checking back on previously graded points. Sometimes previously graded points change in elevation as the overhang is graded.

It is common practice for the contractor to rough grade the overhang approximately 1/2" low. It is then adjusted to final grade as directed by the engineer. It is usually easier and quicker to jack or wedge the overhang up in lieu of trying to

lower it. Overhang support geometry may cause a grade change at the edge of deck if both the interior and exterior supports are not graded simultaneously. This is usually not a problem if both overhang supports are rough graded before the final grading operation. After grading, the joists should be feather wedged tight and the overhang eyeballed.

4-2.4 SCREEDS

Since screeds are normally placed on the overhang, one method for grading the screed is to shoot the screed using the overhang grades and adjust the Lenker rod to compensate for the elevation difference between the overhang and the screed. Another method is for the contractor to grade the screed with a template, or "story pole", set on the graded overhang. Still another method, although it is not generally recommended, is for the Contractor to grade both the overhang and the screed from the deck grades on the exterior girder.

Screeds should be spot checked for adequate support. Screeds for a Bidwell finishing machine should be 2-inch diameter heavy wall pipe with spacing of supports not exceeding 30-inches (See Appendix 4). The screed pipe should also be checked to make sure that it is in good condition.

The screeds should run the full length of the pour and extend beyond both ends a sufficient distance to permit the finishing equipment to clear the entire pour area. Screeds must be graded beyond the limits of the pour to assure proper grade at

the bulkheads and paving notches. Screed pipe splice sleeves should be in place to prevent cantilever action of the screed pipe. Screed pipe saddle adjustments and overhang adjustment nuts have been known to turn when subjected to vibration and should be wired or secured by other means in order to prevent rotation. All screed support elements should be checked during concrete placement. Nonuniform screed displacement or settlement can be caused by:

(1) lack of washers between adjusting nut and edge of deck panel;

(2) spaces between top plate and studs of overhang panel;

(3) spaces between overhang soffit and edge of deck panel.

The field notes and a level should be available during every deck pour in case there are any grade problems.

4-2.5 BULKHEADS

Section 51-1.11 of the Standard Specifications states that "Longitudinal construction joints in the bridge decks, if used, shall be located along the lane lines, unless otherwise shown on the plans or permitted by the Engineer." Past practice has been to try and place longitudinal bulkheads within a foot of a lane line.

To insure positive support, bulkheads and particularly screeds should be located over girder lines whenever possible. Check reinforcing steel splice details with regard to joint locations. Avoid the bend areas of truss bars as they are very

difficult to work around. If the bulkhead has to be installed on the lost deck-in a girder bay, the formwork may require "legging up from the soffit" to minimize deflection and settlement. Refer to the appropriate section of the Standard Plans and/or the Project Plans for allowable deck construction joint details!

Transverse bulkheads are placed at the inflection points of the structure (usually the 1/5 point) or in the deck compression areas. The location can vary somewhat on prestressed box girder bridges.' Reinforcing steel splice details with regard to joint location should be discussed before reinforcing steel fabrication and again during planning of deck concrete placement. Grading transverse bulkheads is basically the same as for paving notches (Refer to section 4-2.6).

Any transverse bulkhead should be regarded as a potential bump or problem area. All operations in the vicinity of a transverse bulkhead should be carefully checked. Grade control is particularly important. A good straightedge during the first bulkhead pour will not guarantee a good riding joint. The area needs to be reprofiled before the second bulkhead pour.

Make sure bulkhead forms are properly constructed and that bulkhead areas are properly cleaned prior to placing concrete. Premature stripping of transverse or longitudinal bulkhead forms should be prohibited due to spalling and the questionable cure that results. Simultaneous pouring on both sides of a joint (especially those having waterstop) should also be prohibited.

4-2.6 PAVING NOTCHES

Paving notches should be graded approximately 1/2" low in order to clear the finishing equipment. When the paving notch is not formed prior to the girder stem pour, be sure to leave the concrete for the girder stem or abutment diaphragm low enough to receive the paving notch forms. Make sure there is an adequate method for holding the paving notch to proper line and grade. Proper width, and straight and plumb joints are important when saw cutting for Type B jointseals. Check reinforcing steel clearances for possible interference with the joint seal saw cuts. The above also applies to sealed hinge joints as well as paving notches. Straight material must be available for a nailing strip used after the grade has been established by the finishing operation. The strip is nailed to the paving notch and is used as a guide for edging only. A 1/4" edger should be used without depressing the concrete. Other methods of finishing along the joint may be used if approved by the Engineer.

4-2.7 INSPECTION TOOLS

1. Twelve-foot straightedge.

   Used for checking localized grade deviations on screeds, bulkheads and armor plate, projecting surface planes of adjacent structural sections and checking surface of finished deck.

2. String Line.

Used to check "lost deck" forms from grade points, deck thickness and reinforcing steel clearances from screeds, alignment of finishing machine carriage rails and laying out lines. Always watch for sags when using a string line.

3. Eyeball.

The final and probably the mostimportant check for line and grade.

4-2.8 FINISHING MACHINES

Grading and inspection of bridge decks, prior to concrete placement, would not be complete without discussing the adjustment of finishing machines.

The Bidwell is the finishing machine most frequently used for bridge decks in California. Other machines that may be encountered are the Borges and Gomaco. The setup and adjustment of the Bidwell will be covered in the text. Bidwell finishing machine weights are listed in Appendix 4.

The greatest care should be taken in adjusting the finishing machine. Depending on the condition of the equipment, these adjustments can take anywhere from 3 to 8 hours and they must be done during daylight. If the machine appears to suffer from poor maintenance, you should be especially cautious and take the initiative to insist on chain repair kits, belts, even extra

bearings, sprockets, etc. Special attention should be applied to the condition of the machine. If the finishing machine breaks down, there is usually no alternative deck finishing method available on the job.

Subtle adjustments of the machine during a pour for a 0.02' change in grade often does more harm than good. Much has been said and written about how a finishing machine can be programmed for various subtle changes in grade. Generally, it is better to leave the machine at one setting for the entire deck pour.

Following is the recommended method for setting up and adjusting the Bidwell finishing machine:

BIDWELL - (Double or single Roller) Deck Finisher.

The following are steps to be used in checking this type finishing machine to insure it is in proper adjustment:

1. String line both trusses and adjust for crown or no crown conditions (make sure carriage is at center of truss and string line is not sagging.)
2. Move carriage to left or right side of deck adjacent to legs.
3. Place string line, which represents finished surface, across deck. String line should be parallel to trusses. Distance from truss rail to string on both sides of roller carriage should be equal.
4. Move machine over string line until ends of both rollers are over the string.

5. Check distance from roller surface to string - it should be the same for both rollers.

6. Lower or raise rollers to string via leg adjustment - both legs, fore and aft, should be moved an equal amount.

7. Fine tune legs (raise rear leg 1/8" if desired).

8. Repeat steps (4) to (7) by moving machine forward until back end of rollers are checked.

NOTE: (A) During the concrete pour, the skew of the rollers appears to be very critical. If a ridge is left behind the roller, it may be due to a change in the skew of the centerline of the rollers. This can be corrected by moving one side of the machine forward or back.

(B) At the beginning of the pour, the auger adjustment should be observed - often it is not set low enough. This will cause the rollers to load up, resulting in a ridge behind the machine.

Footnotes: 1. See Appendix 4 for "Bridge Deck Safety."

SECTION 5

CONCRETE PLACEMENT AND CONSOLIDATION

5-1 TRANSPORTATION

5-1.1 EQUIPMENT

Section 90-6.03 of the Standard Specifications in effect allows the Contractor to transport concrete by any means of conveyance, providing the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation, and providing the mixed concrete, after hauling, conforms to the requirements of Section 90-6.01 "General". This section establishes tests and criteria for mixed concrete suitable for placement.

Usually, concrete is delivered to the job site via truck transit-mixers. Due to their infrequent use, other methods of transportation such as truck agitators, open top vehicles, barges, etc., will not be discussed. These methods are used for special cases and should be individually investigated.

5-1.2 DELIVERY RATE

Since the rate of concrete placement affects the finishing operation, the Contractor's proposed or stipulated delivery rate warrants consideration.

Let's assume that the contractor plans to place 600 C.Y. at 45 C.Y./hr. This means that your pour will take a minimum of 13 hours plus. So if you start at 7:00 a.m., you'll finish placement and strike off around 8:30 p.m. The contractor tells

you that he has asked for 5 trucks, but can only get 4. However, he has been assured by the supplier that this will be more than ample as each truck carries 10 C.Y. of concrete. During previous pours, you have noticed that it takes roughly 5 minutes to discharge a 10 C.Y. truck, haul time to and from the plant is roughly 30 minutes each way, and it takes another 10 minutes to charge the mixer. Considering just the pour rate of 45 C.Y./hr., you need 4.5 trucks/hour or one every 13+, say 14 minutes. However, in order to keep up a steady rate of pour, one must consider the complete cycle a truck would make which is 75 minutes. Therefore, if we divide the 75-minute cycle by the 140 minute pour rate, we find 75/14 = 5.4 trucks or 6 trucks are needed. Inform the contractor, according to the figures he has supplied, that at least 6 trucks would be required to maintain 45 C.Y./hr. and that lights may be needed, a double shift worked, etc.

The secret of a successful pour is getting a good start and maintaining a constant delivery rate. Increased mechanization and decreased use of manual methods have allowed deck pours to proceed at a rate governed by the capacity of the finishing equipment and the rate of delivery and rarely by the physical limitations of the crew. Therefore, it is evident that generally, pour rates can be reduced to mathematical calculations with some allowances for mechanical malfunctions and very little allowance for the **human factor?

5-1.3 MIX CONSISTENCY AND UNIFORMITY

Section 90-6.01 of the Standard Specifications states that "All concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cement? Variations in consistency of the mix should be avoided. Changes in penetration, gradings, etc., have a cumulative effect on the ease of finishing, and are reflected in the finished surface.

5-1.4 INSPECTION AND TESTS

Methods and frequency of sampling and testing concrete are covered in the Concrete Technology Manual and the Construction Manual. Uniformity of mixed concrete is checked by differences in penetration (California Test 533) and variations in the proportion of coarse aggregate (California Test 529). The difference in penetration of two samples from the same batch or truck shall not exceed 1/2".

Concrete tickets, particularly those for the first loads should be checked for conformance with specification requirements. Section 90-6.03 of the Standard Specifications states that "Each load of ready-mixed concrete delivered at the jobsite, except loads used for pavement, shall be accompanied by a ticket showing volume of concrete, the concrete mix identification number, and the total amount of water added to the load. The ticket shall also show the time of day at which materials were batched and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is

charged." Construction Memo 100-3.0 outlines the procedure to be used for checking load tickets. (See Appendix 5).

Section 90-6.03 of the Specifications also states that "No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer." Furthermore, Section 90-6.06 of the Specifications gives limits as to the maximum amount of free water that can be incorporated into the concrete and also regulates the consistency of the concrete based on nominal penetration requirements.

Currently, the Contractor designs and proposes the use of a concrete mix based on the desired workability of the mix, the local resources available, and the requirements of the Standard Specifications (and Special Provisions). This mix may contain mineral and/or chemical admixtures to enhance the performance of the concrete so long as the use of these admixtures is approved by our Translab. The Engineer reviews the proposed concrete mix designs and approves the mixes that comply with the specifications.

After the concrete is delivered to the point of discharge, the Engineer usually allows the Contractor to regulate the amount of water that is added to the mix in order to maintain proper consistency and uniformity of the concrete. This places the responsibility on the Contractor, eliminating the need for constant inspection at the point of discharge. The Contractor knows not to exceed the maximum allowable water per the mix

design and/or the Standard Specifications for fear of rejection, and yet experience demands that the Contractor add enough water to get a workable mix.

It is very important to recognize that water should be added before the truck starts discharging. After discharge is started, the Contractor usually doesn't know the quantity of concrete with sufficient accuracy to add water with the assurance that the maximum water content will not be exceeded.

5-2 CONVEYANCE AND PLACEMENT

5-2.1 EQUIPMENT

In the past, Contractors have tried several different methods for placing concrete during deck pours. Buggies, conveyor belts, pumps, and buckets are a few of the more successful methods that have been used. Concrete buckets, pumps, and belts will be covered because these are the methods that have the greatest chance of being encountered out in the field.

5-2.1.1 CONCRETE BUCKETS

Obviously, when mentioning concrete buckets as a method of conveyance, we are referring to the crane-bucket method of placement. One cannot be considered without the other. Generally, we can assume an average pour rate of 45 C.Y./hr. when using one crane with two one-C.Y. buckets.

Some advantages of using the crane-bucket method are as follows: The crane can be utilized on other phases of work,

therefore, pours do not require special equipment and setup. The crane has a high degree of mobility which allows concrete placement under difficult conditions. A homogeneous mix is assured in most cases. Clean-up is minimal.

Some disadvantages of using the crane-bucket method are as follows: The crane's radii must encompass the pour front and often there are areas that are inaccessible. High pour rates require the use of additional cranes which leads to a safety problem with swinging booms. Overhead wires are a serious hazard. Impact due to concrete dropping from a high bucket can cause form failure.

When the crane-bucket method is used, care should be taken so that while the bucket is being filled with concrete it is positioned on a sheet of plywood in order to catch the spills and to keep the bottom of the bucket frame and boot out of the dirt.

5-2.1.2 CONCRETE PUMPS

Currently, concrete pumps are the most popular method for placing deck concrete. Truck-mounted pumps are more versatile and have higher pour rates than any other previously used method of conveyance. Present day pumps are expected to deliver up to 100 C.Y./HR without any major breakdowns or malfunctions. More favorable consideration is given to pumps due to this greatly increased reliability. In the past, pumps could be-expected to malfunction at least once during a pour. This increased

reliability and higher pour rate can be attributed to improvements in pump design and the increased use of admixtures.

Cranes with buckets and other previously used methods of conveyance are generally limited to a single or perhaps two locations for receiving ready-mix concrete, pumps are very mobile and can change locations very quickly. This is very important in keeping a fresh pour front for deck concrete placement. In areas where overhead airspace is congested with utility lines, etc., pumping is more advantageous because pumps normally require less headroom. Pumps also offer a less disruptive, ominous presence and are consequently less hazardous since the absence of swinging buckets or belts eliminates evasive maneuvering by the crew.

5-2.1.3 BELT CONVEYORS

During recent years, belt conveyors have been encountered on concrete pours where it is impractical or impossible to use pumps or buckets. Belts are utilized in areas that have impaired vertical clearances, traffic restrictions, and obstructions. Belts can produce pour rates of 65 C.Y./hr.

Some disadvantages of the belt are as follows: Often they require special supports or must be located along girder stems. Cleanup due to spillage is often a problem and care must be taken to place rugs or plastic sheathing at terminal points. Safety of the workers in the area of the terminal section requires special consideration. The chance of segregation is always present. Uneven pour fronts may result from removing support rail sections

as the pour progresses, thus causing inaccessible areas. Often unbalanced falsework loadings are encountered. Since the monitor must place concrete on both sides of the conveyor rail before it is moved back and the rail removed, the operator may fill one side completely before moving to the other. Rate of placement and placing sequence requires careful monitoring to assure proper vibration. Some belts must complete an entire 10' section before the finishing machine can move forward.

5-2.2 INSPECTION

Forms and surfaces that are to come into contact with the fresh concrete must be wet. Ponding of water should be prohibited. Uniform consistency of concrete and a uniform pour front parallel to the finishing machine should be maintained. The concrete must be adequately consolidated but not overvibrated. Reinforcing steel clearances should be continuously checked and displaced steel repositioned, blocked and tied, and broken dobies replaced, etc. The position of waterstops, deck drains, conduit, and prestressing hardware and appurtences should be checked and repositioned if displaced.

5.03 VIBRATION

Section 51-1.09 of the Standard Specifications states that "Concrete shall be placed and consolidated by methods that will not cause segregation of aggregates and will result in a dense homogeneous concrete which is free of voids and rock pockets."

Also, section 51-1.09 requires the contractor to consolidate all concrete by means of high frequency internal vibrators within 15 minutes after it is deposited in the forms.

Prior to vibration concrete presents a dry, irregular surface, while vibrated concrete presents a distinctively different appearance. Vibrated concrete takes on a moist #appearance as the fines move to the top and the large aggregates settle.

The technique of the operator should vary with the depths and complexity of the section. In deep sections where it is possible to get full penetration of the vibrator, it is imperative that the person operating the vibrator hit the concrete approximately every 2' and the head of the vibrator enter almost vertically. In thin deck sections the 2' separations must also be observed but it is not as important to enter the concrete vertically. Some may object to this statement, but considering the power of the vibrator and the depth of the section, it is not necessary to enter vertically for adequate consolidation.

The vibrator should not be dragged horizontally over the top of the concrete surface. Neither should the vibrator be allowed to run continuously while the operator is occupied with other things. Special care must be taken in vibrating areas where there is a high concentration of reinforcing steel.

Additional information on concrete placement and consolidation can be found in the Concrete Technology Manual.

SECTION 6

CONCRETE FINISHING AND CURING

6-1 SPECIFICATION REVIEW FOR CONCRETE DECK FINISHING

6-1.1 GENERAL SPECIFICATIONS

Section 51-1.17 of the Standard Specifications pertains to deck finishing. They are "end result specifications." In other words, the specifications require that bridge decks meet certain qualitative criteria before they will be acceptable. Keep in mind that the contractor is free to use virtually any method he thinks is appropriate to achieve a deck that meets the requirements of the specifications.

The general criteria for bridge decks are as follows:

1. Decks will meet the specified requirements for smoothness in the longitudinal direction as measured by the bridge profilograph and smoothness transversely as measured by a 12 foot straight edge.
2. Decks will have a surface crack intensity limit based on crack size and frequency. Any cracks exceeding this criteria are required to be pressure injected with epoxy.
3. Decks will have a surface texture which will provide a minimum specified friction coefficient of 0.35.
4. Deck joints, if needed, will be placed at locations approved by the Engineer.

5. The concrete for decks shall be at least 7 sack concrete and meet all the appropriate specifications for concrete.

It should be mentioned that under the end result specifications for bridge decks, quality is the sole responsibility of the contractor.

6-1.2 SPECIFICATION HIGHLIGHTS

The following specifications are from the January 1988 Standard Specifications, Section 514.17:

1. The completed surface shall be constructed true to the required grade and cross section and to the smoothness, surface texture, and surface crack requirements specified.
2. Unless stated otherwise in the Special Provisions, the Engineer will set deck elevation control points including all camber allowances for use by the contractor to establish grade and cross section. The points shall not be closer than approximately 8 ft longitudinally and 24 ft transversely to the centerline of the bridge. (See Appendix for setting lost deck grades).
3. Prior to concrete placement, the contractor shall set to grade all rails and headers used to support the finishing equipment and shall move all finishing equipment over the entire length of the section to be placed to check steel and bulkhead clearances.

4. Surface crack intensity shall have less than 50 LF. of 0.020 in. wide cracks in any 500 sqft. of deck area. Surface crack intensity shall be measured prior to the release of falsework or prestressing. Cracks in excess of this limit shall be filled with pressure injected epoxy. Cracks to be filled shall be cleaned and filled so that all portions of the crack wider than 0.005 are completely filled with epoxy.

5. The smoothness of completed roadway surfaces of structures, approach slabs, and adjacent 50 ft of approach pavement will be tested in accordance with California Test Method No. 547. (See Bridge Construction Records and Procedures Memo 112-2.0, "Testing Bridge Deck Surfaces for Compliance with the Straightedge or Profilograph Requirements" for policy regarding communications with the contractor and other important information). The test consists of 2 profiles in each lane 3 ft from the lane lines plus one in each shoulder, 3 ft from the curb. Individual high points must be less than 0.25 in. and the profile count may be up to 5 in any 100 ft. section. The surface shall not vary more than 0.02 ft in 12 ft. transversely when measured with a straightedge. Be sure to run the profilograph in a direction parallel to traffic.

6. The contractor shall schedule the profildgraph testing with prior notification to the Engineer of at least 7 days.

7. When seal coats are called for, the deck must meet the requirements for smoothness before the seal coat is applied.
8. Surfaces to be covered by more than 1 in. of material shall not vary more than 0.03 ft. from the 12 ft. straight edge.
9. Any surfaces not meeting the smoothness criteria shall be ground. After grinding is completed, the minimum remaining cover over the reinforcing shall be l-1/2 in. In areas where you are fairly certain that grinding will occur, (around hinges and construction joints) it is wise to plan for some additional cover.
10. The deck shall have a surface texture that will develop a friction coefficient not less than 0.35.
11. Decks to receive membrane deck seals shall be finished smooth.

6-2 CURING BRIDGE DECKS

From section 90-7.03 of the 1988 Standard Specifications, "Curing Structures", the following is found: "The top surface of Highway bridge decks shall be cured by both the curing compound method and the water method, except that the curing compound shall be the ...pigmented curing compound...." In most areas of the State and in all the major metropolitan areas, water based pigmented curing compound is the only type of curing compound permitted by the Air Quality Board.

Curing compound shall be applied progressively during deck finishing operations immediately after finishing operations are completed on each individual portion of the deck. The water cure shall be applied not later than 4 hours after completion of deck finishing, or for portions of the deck completed after normal working hours, the water cure shall be applied not later than the following morning. Be sure that the curing compound is sufficiently dry and the concrete has sufficiently set before the rugs or mats are placed on the deck.

6-2.1 CURING COMPOUND

When the surface of the deck has been textured and the surface sheen is still on the concrete, curing compound should be applied. It must be applied with power operated spraying equipment that atomizes the cure. The application rate, a minimum of 200 sqft. per gallon, is specified in the Standard Specifications. Conditions during the pour, such as wind and low humidity, may require a heavier application rate. Remember, the purpose of curing compound is to prevent loss of surface moisture from the fresh concrete, so make sure that the cure is applied at the right time and coverage is complete and even.

In addition to being released by Translab, a one quart sample of the curing compound proposed for use must be taken and tested for compliance with the Standard Specifications. Before taking a sample and during its application, the curing compound must be well mixed to perform effectively. Mixing must be done with mechanical type paddle or screw agitating mixers.

6-2.2 FOGGING

During hot weather especially if it's windy and /or the humidity is low, fogging the fresh concrete deck may be necessary if the cure application is late. The contractor must begin fogging the deck immediately before the surface sheen of the concrete disappears and before surface cracks begin to appear. The purpose of fogging is to keep the concrete cool and prevent premature moisture loss and uneven shrinkage in the concrete before the cure is applied. *Fogging can be detrimental to the deck if too much water is applied and it puddles or runs off the deck and washes the fresh concrete. Fogging must also be done with the correct equipment. This means a fogging nozzle in good operating condition that adequately atomizes the water, not heavy squirting. See Bridge Construction Records and Procedures Memo 105-3 and 105-4 for additional information.

6-2.3 WATER METHOD

The water cure shall be applied not later than 4 hours after completion of deck finishing, or for portions of the deck completed after normal working hours, the water cure shall be applied not later than the following morning. The concrete shall be kept wet continuously for seven days. Cotton mats, rugs, carpets, burlene or earth or sand blankets may be used as the moisture retaining medium. Be sure that the curing compound is sufficiently dry before the rugs or mats are placed. It is recommended that the contractor wet down the deck before the rugs

or mats are placed. The moisture retaining medium must be wetted immediately after placement and kept wet for at least 7 days. Be sure to remind the contractor that consideration must be' given to the control of cure water runoff so that it doesn't interfere with traffic, erode slopes, footings or falsework pads.

APPENDIX 1

Material Plant Safety --- Checklist Helper 1/89

Plants producing only for the contract (jobsite plants) are to be fully checked for compliance with both the United States Department of Labor, Code of Federal Regulations, Parts 1900-1910, and Cal-OSHA -Title 8, Calif. Administrative Code. Plants serving customers other than Caltrans (commercial plants) shall be inspected only in areas frequented by Caltrans Inspectors. Std. Specifications = [ ]

A. Asphalt Cement Sample Area -

1) Sample Height - (39-3.01C] - Readily accessible and in an area free of dangerous obstructions, less than waist high.
2) Plumbing Size - [39-3.0C] - I/2" or 3/4" valve and nipple.
3) Insulation/Shielding - 8CAC sec 3308 - Hot pipes guarded against contact when within 7 feet vertically above working level, or within 15 inches horizontally from stairways, ramps, or ladders.
4) Housekeeping - 8CAC sec 3272, 3273, 5551 - Clear aisles and walkways 24 inches wide and 6 feet 8 inches high, protected against slipping and free of oil, grease or water and dangerous obstructions and debris. Ditches, pits, excavations and surfaces in poor repair shall be guarded. Leaks shall be controlled and spills cleaned up promptly.
5) Fire Protection - 8CAC sec 6151 (d)(4) - Fire extinguisher for Class B fires shall be readily accessible within 50 feet.
6) Underground Tank Access - 8CAC sec 3480(c)(4) - The access shall be provided with a grate, 2 inch maximum opening, or covered.
7) Access Stairs - 8CAC sec 3234 - Minimum of 22 inches wide, 9.5" maximum rise, and 8" minimum run. Railings on open sides.

B. Aggregate/Cement Sample Area -

1) Access Stairs - 8CAC sec 3234 - Minimum of 22 inches wide, 9.5" maximum rise, and 8" minimum run. Railings on open side(s).
2) Guardrails - 8CAC sec 3210 - On all working levels 30 inches above the level below.
3) Floor Holes - 8CAC sec 3212, 1632 - Shall be completely covered.
4) Housekeeping - 8CAC sec 3272, 3273, 5551 - See A-4 above
5) Sample Size - [39-3.04A, 39.3.038(2), 90-2.02) and the Construction Manual - Safe and suitable. Manually handled aggregate, 60 to 80 pound maximum. size that represents material being used. Larger aggregate samples to be handled by contractor furnished equipment.
6) Conveyor Lockout - 8CAC sec 4001, 3314 - Power source de-energized to prevent inadvertent movement.
7) Dust - (9-2.02) - Dust shall be controlled by the contractor. The plant inspector will have to wear a fitted dust mask if excessive dust can't be controlled in the sample area.
3) Sample Support Rails - A safe and suitable sample is impossible to obtain without adequate sample tray support rails when sampling batch. plants at the weigh hopper.
9) Conveyor Startup Warning - 8CAC 3999(h) - Shall not start conveyor until all employers are clear or have been warned.

C. Aggregate Belts/Drives -

1) Drive Belt Guards - 8CAC 4070, 4075 - Required when within 7 feet of working level.
2) Conveyor Guards - 8CAC 3999(b) - Completely guarded on both sides of head and tail pulleys.
3) Under Conveyor Clearance - 8CAC 3999(c) - Must be covered where clearance is less than 6 foot 6 inches at areas where employees pass under the conveyor.
4) Guarding - 8CAC 3999(a) - Screw conveyors must be completely covered; chains, sprockets, v-belts, revolving parts must be shielded.

D. Control Room -

1) Stairs, Landings, Guardrail - 8CAC 3210(a), 3231, 3235 - Hand rail on open side(s), unless 3 or less risers, 30 to 34" high which will support 200 pounds. Stairs with 36 inch minimum width, rise no less than 4" or greater than 7.5". run no less than 10", slip resistant treads, maintained clear and in good repair.
2) Fire Protection - 8CAC sec 6151 (d)(4) - Fire extinguisher for Class B fires shall be readily accessible within 50 feet.
3) Emergency Exit - 8CAC 3219, 3235 - Must be free of obstacles, 3 foot minimum width, if furnished with a landing it must be no more than 1" lower than the threshold, if no landing is furnished the door shall be marked with a sign "Danger Stairway - No Landing".
4) First Aid - 8CAC 3400 - Must have first-aid kit available. Training infirst-aid if not in near proximity of a hospital. At isolated locations, provisions for prompt medical care must be made in advance of serious injuries.
5) Drinking Water, Toilet Facilities - 8CAC 3363, 3364 - These items must be provided. Multiple with over 5 employees.

E. Yard Equipment -

1) Loaders, Trucks - 8CAC 3706, 1592 - Backup alarms are required for loaders and trucks. Roll over protection is required for loaders. The wearing of seat belts is mandatory.

General -

1) Lighting - 8CAC 3317, 3215(e) - Must be adequate to provide a safe place of employment.
2) Wash Pits, Dust Collection Pits - 8CAC 3213 - Shall be either covered or protected with guardrail.
3) Electrical - 8CAC 2340.17 - No exposed energized parts and all cover plates must be in place.
4) Automatically Controlled Equipment - 8CAC 3320 - Must be equipped with a sign declaring auto start up.

California Department of Transportation

MATERIAL PLANT SAFETY CHECKLIST

Form HC-12 (1-89)

Plant	Location	Date
Jobsite/Commercial Plant	Report No.	Inspection By
Plant Type		District
Plant Owner		

Plant Area		Deficient	Remarks
A. Asphalt Sample Area	1) Sampling height		
	2) Plumbing size		
	3) Insulation/shielding		
	4) Housekeeping		
	5) Fire protection		
	6) Underground tank access		
	7) Access stairs		
B. Aggregate/Cement Sample Area	1) Access stairs		
	2) Guardrails		
	3) Floor holes		
	4) Housekeeping		
	5) Sample size		
	6) Conveyor lockout		
	7) Dust		
	8) Sample support rails		
	9) Conveyor startup warning		
C. Aggregate Belts/Drives	1) Drive belt guards		
	2) Conveyor guards		
	3) Under conveyor clearance		
	4) Other conveyors		
D. Control Room	1) Stairs, landing, guardrail		
	2) Fire protection		
	3) Emergency exit		
	4) First aid		
	5) Drinking water, Toilet facilities		
E. Yard Equipment	1) Loaders, Trucks		
F. General	1) Lighting		
	2) Wash pits, Dust collection pits		
	3) Electrical		
	4) Auto controlled equipment		

Interlock Set Point							Primary Indicators		
Material	Zero	+/- % or lbs	Cutoffs	+/- % or lbs	Type	Manufacturer	Model No.

HOPPER SCALE TEST

Scale No. / Material	Capacity / Grads	Test Weight	Build up weight	Total Applied Weight	Indicated Weight	Error / Grads	Remarks / Settings

REMARKS

CALIFORNIA DEPARTMENT of TRANSPORTATION

CALIF. TEST 109

Form HC-14 (Rev 2-88)

VEHICLE SCALE CK	REPORT NO.
Agency	Date
Error ?	Dist

GALLONS to TONS	TPH to GPM	Lbs. Per Gallon
$\frac{\text{GALLONS X D}}{2000}$ =TONS	$\frac{\left(\frac{\text{Tons x 2000}}{\text{D}}\right)}{60}$ = GPM	(D) SPG. X 8.34 use temp factor if ATC not in use

TEST BY

Sheet of

RUN NO.	MATERIAL TYPE	Time Test Length	Rate TPH or GPM	Temp or Temp Factor	Actual Test Weight (A)	Metered Weight Indicated (B)	Error A-B (C)	% Error $\frac{C}{A}$ X 100	Span	Remarks

Plant Owner	Plant Type	Location
Manufacturer	Model No.	Approx. Age
Controller M/No.	Weighbelt Controller M/No.	
Meter M/No.	ATC M/No.	

Asphalt Grade
Refinery
M & R SpG
Refinery SpG
Used

OPERATIONAL LIMITS

Material	Range

APPENDIX 2

State of California

Business, Transportation and Housing Agency

Memorandum

To: ALL JOBS

Date: September 25, 1989

File:

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF STRUCTURES
OFFICE OF STRUCTURE CONSTRUCTION

Subject: LOST DECK FORMWORK

Low velocity powder driven nails used to attach wood ledgers to concrete have been tested and approved for use in new contracts containing appropriate Special provision amendments to Section 51-1.05 "Forms" of the Standard Specifications. On going contracts, or contracts'which do not contain the appropriate Special Provision language, a Contractor requested Change Order may be written to permit the use of powder driven nails in the lost deck forming system, in accordance with Falsework Manual Memo No. 7 (6/14/89). The Office of Structure Construction has determined that an agreed price rebate of $.11 per square foot of lost deck area should be used in the change order.

A. P. BEZZONE, Chief
Office of Structure Construction

Inspection Check List for Bridge Deck Construction

Developed, from-Outline of Field Construction Procedures by Jon Mehtlan.

Deck construction actually starts with the soffit forms being properly graded and a check of the girder reinforcing steel stirrups. The length of the stirrups should be checked so that they will be at the correct height in the deck.

1. Lost Deck

   1) Make sure that soffit vents are clear, drains and there support systems are checked.

   2) Measure grade points contractor will use. Plot and pick grades on 4-scale.

   3) Shoot grade points and give Contractor cut/fill sheet to top of deck. If construction staking is an item, compare Contractor's submittal with ours and spot check grade points.

   4) Check stems for over height; no more than 0.1' into fillet (OSC Policy).

   5) Check bays for cleanness. No loose material allowed in bays (Standard Specifications 51-1.05)

   6) Check lost deck form work for compliance with approved submittal and workmanship.

   7) Use string line between grade points to check lost deck elevations, deck thickness.

   8) Seal any gaps and holes that will result in significant grout leaks.

   9) Finally, check adequacy of sandblasting done on tops of girders and clean up.

2. Overhang

   1) Determine what method the Contractor will use to grade overhang.

   2) Measure adjusting devices, plot and pick grades.

   3) Grade overhang. If construction staking is an item, spot check overhang grades as necessary to assure compliance.

4) Plywood overhang forms must conform to the same conditions as soffit plywood.

On sharp radius curves, gaps will occur between plywood and stem and at joints. Some pattern must be developed to mitigate this.

5) Eyeball edge of deck chamfer for smoothness.

6) Safety rail along edge of deck must go up as overhang is being formed and remain in place until the barrier rail has been completed.

3 Deck Reinforcing Steel

1) Check main cap reinforcement for size, number and end.

2) Main cap rebar should be tied into or blocked up to stirrup hooks.

3) **See Standard Plan BO-5** for spacing of transverse deck steel.

4) Check height of stem stirrup at bend. This will determine height of top mat. If stirrups ar to low, > 3/8", other methods like additional blocking will be required to achieve correct height of top mat.

5) Splice transverse deck steel if necessary as per Section **52-l.08 of the Standard Specifications.** Truss bars should preferably be spliced between girders.

6) Check bottom mat clearance (adequate blocking), height of top mat (additional blocking), and securely tied intersections. If mat feels loose, more ties and blocks are required.

Check barrier rail steel, extra bars needed at joints etc.

4. Deck Check Out Before Pour

Other items to be aware of in addition to steel:

1) Access openings in correct location; Are bolts, etc., in place and secure.

2) Blockouts for joint seal assemblies.

3) Is longitudinal construction joint located on lane line (Standard Plans BO-5).

4) Is transverse deck joint at 1/4 point (Standard Plans B0-5).

5) Are prestressing vents secure and retrievable. Strap tie to hand rail is a good way to find these later.

6) Check barrier rail steel and additional bars for electrical components (pull boxes).

7) Check end bulkheads for line and support.

8) Eyeball overhang chamfer and screed pipes for smooth line.

9) A check of the finishing machine roller clearance to the top mat of steel should be made by tying a piece of lath or other 2" thick guide across the bottom of the rollers and traversing the deck, back and forth from one end to the other.1 Record the deck thickness at various locations, and if it becomes apparent a pattern of too thick or too thin of a deck is developing, this can be corrected by adjusting the machine or the screeds.

10) Check height of deck drain inlets in relation to finishing machine roller.

5. Deck Pour

1) Verify mix design and check consistency of first few trucks.

2) Be sure lost deck forms and rebar are damp just ahead of pour front. On hot days, water keeps steel cool and will help prevent possible cracking.

3) Don't let pour front get more than 10 or 12 feet ahead of finishing machine. If it does,‘ stop placement until the machine can catch up.

4) Application of curing compound is to be by power

and should be as close as practical to the finishing operated equipment, **Standard Specifications 90-7.01B**, machine. During hot, windy conditions, application of water spray will certainly help prevent cracking on newly finished surface. Water based curing compound should not be placed on standing water as it will evaporate with the water.

5) If lost deck fails, all concrete must be removed from the bay/bays.

6) Applying rugs or mats shall begin within 4 hours after completion of deck finishing and no later than the next morning for portions finished after end of shift. **(Standard Specifications 90-7.03)**

7) Read **Standard Specifications 51-1.17,** "Finish Bridge Decks".

8) Recheck tattle tales for additional falsework settlement.

6. After Deck Pour

1) Periodically check rugs for dampness. Rugs generally need water at least twice a day.

2) Contractors generally remove cure rugs at end of cure period. This must be done to inspect deck for shrinkage cracks prior to prestressing or release of falsework as set forth in **Section 51-1.17 of the Standard Specifications.**

3) If deck surface does not meet the crack intensity specifications, Contractor is to be notified by letter noting the affected area.

7. Hinges

1) Establish a bench mark over a column once the deck is poured and use this to monitor hinges.

2) Monitor hinges thusly:

a) From tattle tales during stem pours, note any difference from that introduced to soffit grade.

b) Immediately after deck pour, establish elevations on deck (min. 3) just behind bulkhead, **say** 1'. Also establish a grid (over bent, 25' back, 50' back) so profile can be developed.

c) Shoot weekly until notified otherwise.

d) Before establishing long span final grades, profile short span deck (10' cc) and compare to theoretical. Spline out long span deck grades if appropriate.

e) Monitor long span same as short span.

f) If long span settles excessively, it may have to be jacked up (Contractor% expense).

g) If short span rotates up more than anticipated it can be ground out later (we usually pay).

3) Prior to installing joint seal assembly, the blocked void is filled usually with sand and topped with 3 to 4 inches of concrete to facilitate profilographing and grinding. Measures should be taken to prevent intrusion of sand into joint.

8. Approach Slabs

1) Grades for these are usually established by comparing with existing deck profile.

2) Treated permeable material is placed and compacted.

3) Fabric, rebar and waterstop are placed for sleeper slab and concrete is placed and finished.

4) Approach slab is placed next following same procedures.

5) Block outs for joint seal assemblies may be required here and are dealt with the same as hinge blockouts.

9. Profilographinq

1) Contractor cleans deck and requests we profilograph deck or decks. Seven (7) days prior notice required **(Standard Specifications 5l-1.17).**

2) Required trace lines are laid out along with stations or some such identification of distance and traces are run according to California Test 547.

3) "Must grinds" are marked on deck and Contractor is notified of their locations in writing.

4) Contractor should review profilograms, and determine how he proposes to bring the entire deck into specification (min. count etc.).

10. Deck Grinding

1) Contractor's foreman should be directing grinding operations.

2) Check behind grinder with straight edge to prevent unnecessary moves.

3) Reduction of high count areas is the Contractor's choice but would be nice to discuss method ahead of time.

4) When Contractor says he is finished, rerun profilograph.

HINGE CURL

This memo addresses the problem of upward deflection of the unloaded short cantilever of the hinged span of cast-in-place P/S concrete box girder bridges. This deflection is experienced prior to load transfer from the long span side and is commonly termed, "hinge curl".

The intent of the following procedure is to give the design engineer a means whereby this "hinge curl" deflection may be predicted and to provide appropriate data on the contract plans dealing with this problem.

The designer is reminded that there is avariable period of time (usually between 30 and 180 days, sometimes much longer) in which the short cantilever remains unloaded after it has been stressed. The period of time and, therefore, the extent of curl is not predictable until the contractor's schedule is known. Experience indicates that the hinge does not always deflect downward at load transfer to the extent that it had previously deflected upward under the influence of the prestressing force. In the past, the camber diagrams which have been shown on the plans have not solved the hinge deflection problem. The following procedure should produce good riding bridges.

Step 1 - Initial BDS Runs

Run BDS for complete structure (including all design loads) using maximum eccentricities for tendon paths. Review and modify prestress path for optimum stress and deflection control. Record P_j and deflections for all paths.

New Memo

Step 2 - Individual Frames

Run BDS for each frame. Place a temporary support at the end of the long hinge span. Use P_j from Step 1. Do not include live loads, weight of closure pour, barriers, future overlay, and/or transfer load from long hinge. Prestress deflections of the unloaded short hinge will be reported by these runs and may be checked with a simple calculation using the following equation:

Equation No. 1 – Uplift of Short Cantilever (see Sketch No. 1)

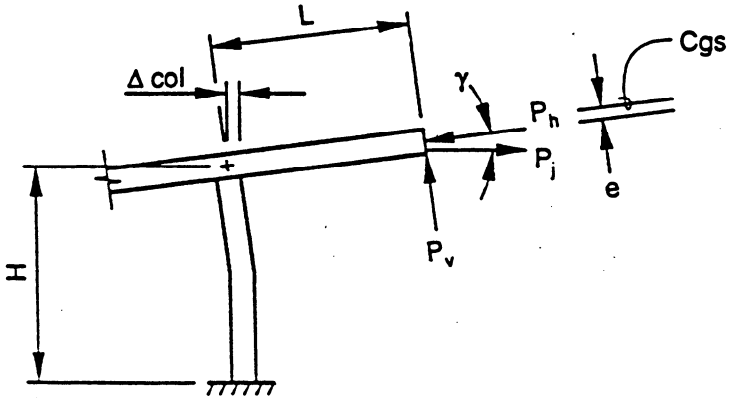
$$\Delta \text{ curl} = -\Delta \text{ col} \frac{L}{H} - \frac{P_v L^3}{3EI} \pm \frac{P_h e L^2}{2EI} + \frac{wL^4}{8EI}$$

(down is positive)

and where:

- w = unit dead load of cantilever
- L = length of cantilever measured to C_L of support
- P_h = horizontal component of P_j
- P_v = vertical component of P_j
- Δ col = deflections of column due to prestress shortening
- H = column height
- e = eccentricity of prestress at hinge
- E = 3,600 ksi = 518,400 ksf ($E = 57{,}000 \sqrt{f'_c}$)

In Equation No. 1, the first term represents the uplift effect due to column deflection. The second and third terms are effects of the prestressing and the last term is the dead load deflection of the unloaded cantilever.



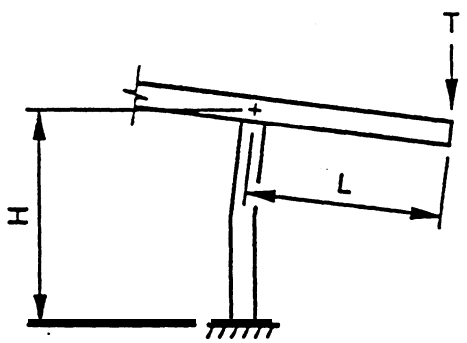
Sketch No. 1

A second run of the short hinge frame, loaded this time with the hinge transfer load at the end of the cantilever, (include hinge concrete) will produce a downward deflection at the hinge. This deflection can be verified quickly with the following equation:

Equation No. 2 -Downward Deflection of Short Cantilever (see Sketch No. 2)

$$\Delta \text{ reaction } = \frac{TL^3}{3EI}$$

where T = Transfer Load (include hinge concrete)



Sketch No. 2

Step 3 - Development of Plan Camber Diagram

This step involves incorporating the predicted deflections into the camber diagram to be shown on the contract plans. The long term effect of creep and **shrinkage** is assumed to result in ultimate deflection three (3) times as great as immediate deflection and this will occur over a four year period. Since the load transfer from the long hinge will usually occur sometime early in the period from 30 to 720 days after prestressing the short hinge span, a camber diagram with tabulated values is to be shown on the plans.

The suggested camber diagram to be drawn for the hinged span is shown in Figure 1. The normal diagram is show along with an enlarged camber curve for the hinge span. Three values of camber are calculated and shown at the hinge. Camber "A" is calculated for the position of the long hinge side and Camber "B" is calculated for the position of the short hinge side, value "C" is the measurement from "A" to 'B".

Previously calculated deflections are modified for long term effects as follows:

Camber "A"' - Camber required for transfer dead load less prestress uplift after load transfer (may be positive or negative value).

30 day value = 2.60 × Δ reaction - 1.60 × Δ curl
60 day value = 2.20 × Δ reaction - 1.20 × Δ curl
90 day value = 1.80 × Δ reaction - 0.80 × Δ curl
120 day value = 1.60 × Δ reaction - 0.60 × Δ curl
180 day value = 1.55 × Δ reaction - 0.55 × Δ curl
240 day value = 1.50 × Δ reaction - 0.50 × Δ curl
360 day value = 1.40 × Δ reaction - 0.40 × Δ curl
720 day value = 1.25 × Δ reaction - 0.25 × Δ curl

Camber "B" - Camber required for short hinge side (may be positive or negative value).

30 day value = 2.60 × Δ reaction - 3.0 Δ curl
60 day value = 2.20 × Δ reaction - 3.0 Δ curl
90 day value = 1.80 × Δ reaction - 3.0 Δ curl
120 day value = 1.60 × Δ reaction - 3.0 Δ curl
180 day value = 1.55 × Δ reaction - 3.0 Δ curl
240 day value = 1.50 × Δ reaction - 3.0 Δ curl
360 day value = 1.40 × Δ reaction - 3.0 Δ curl
720 day value = 1.25 × Δ reaction - 3.0 Δ curl

Value "C" - Measurement from position "A" to position "B" (will always be a negative value).

30 day value = -1.40 × Δ curl
60 day value = -1.80 × Δ curl
90 day value = -2.20 × Δ curl
120 day value = -2.40 × Δ curl
180 day value = -2.45 × Δ curl
240 day value = -2.50 × Δ curl
360 day value = -2.60 × Δ curl
720 day value = -2.75 × Δ curl

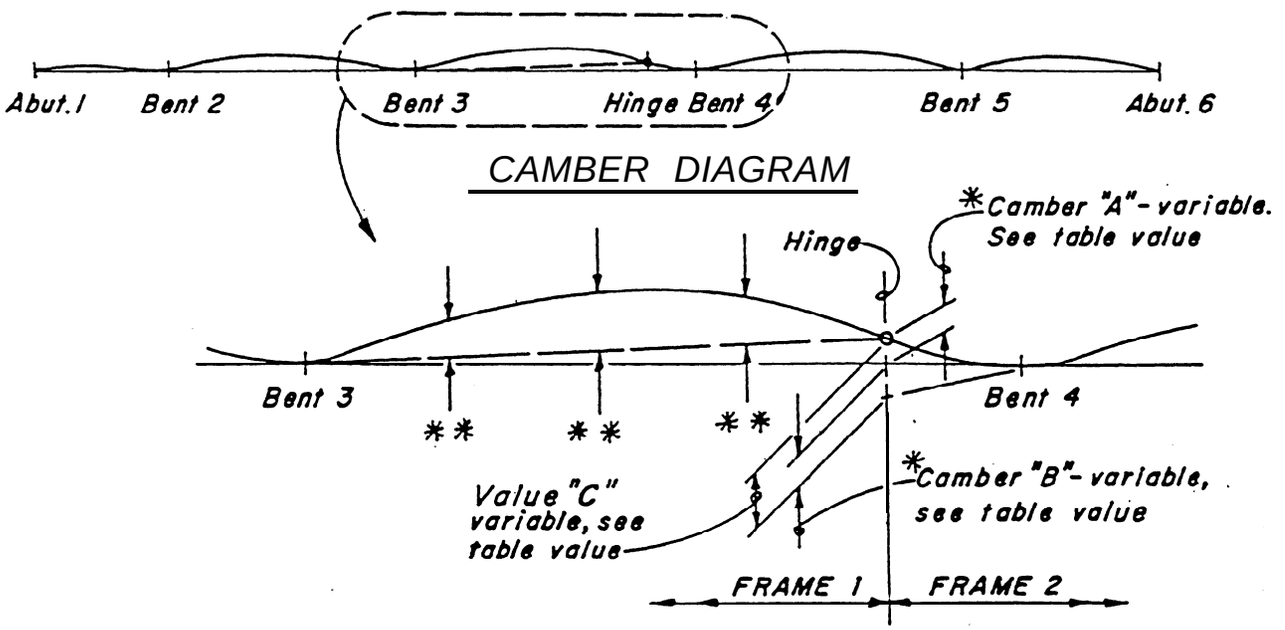


Figure 1. Camber Diagram

* See table for values to use - depends on period of time between prestressing of frame 2 and load transfer from frame 1.

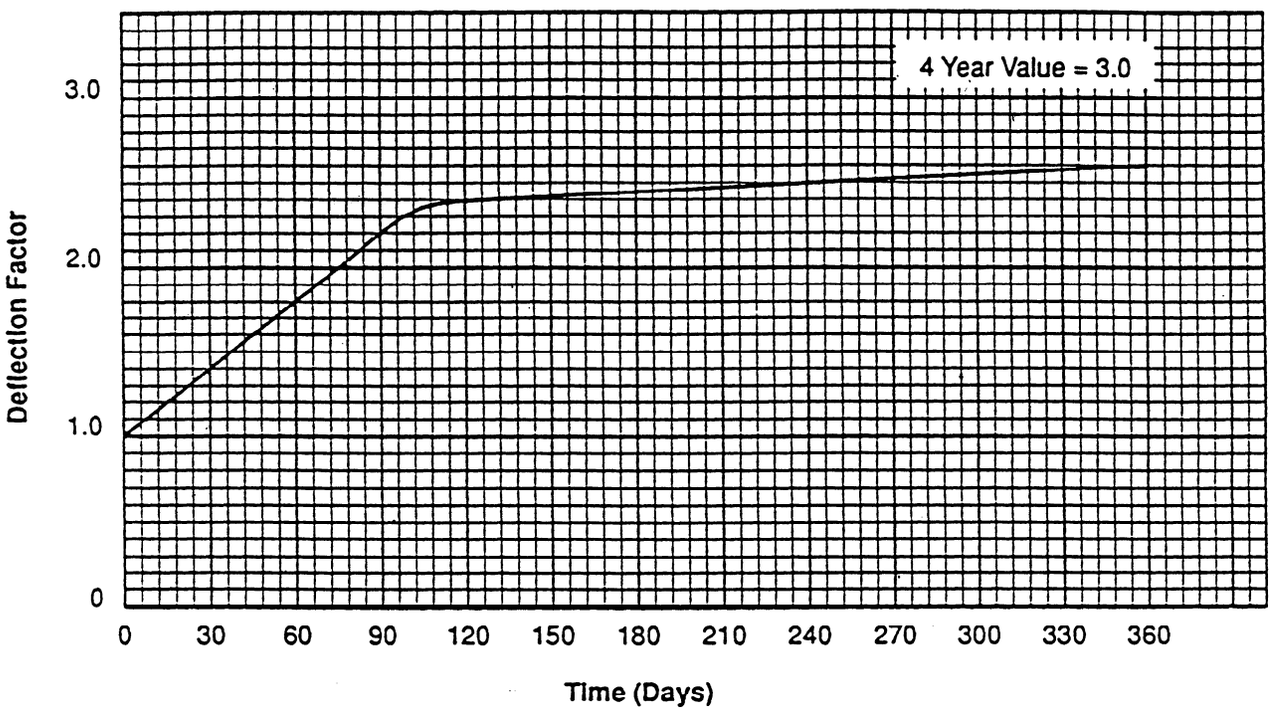
** Adjusted values of camber taken from long hinge values given in complete structure run of BDS.

TIME DEPENDENT CAMBER VALUES

Elapsed time in days measured from prestressing short hinge side till closure and load transfer	Camber "A"	Camber "B"	Value "C"
30 days			
60 days			
90 days			
120 days			
180 days			
240 days			
360 days			
720 days			

Table 1. This table is to be shown on contract plans.

The long term effects that are incorporated in the previous calculations were determined from a plot of time vs. deflection as shown below.



Note: It is assumed that there will be a trial period during which this method of handling camber in hinged spans will be monitored and adjusted as needed.

Philip C Warriner

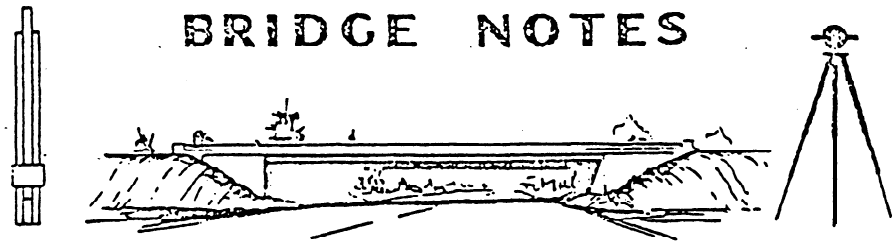
Guy D. Mancarti

AWD:jgf

APPENDIX 3

BRIDGE DEPARTMENT

BRIDGE NOTES



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CARELESSLY PLACED RE-BAR CAUSES STRENGTH LOSS

The following study points out the need to accurately place and position the deck steel as called for on the plans. Changes in clearance of the top reinforcing steel in transverse reinforced slabs affects the moment and shear capacity of the slab in the area of negative moment. Figures A and B show a standard slab taken from the "Bridge Planning and Design Manual". Table A shows the effects of varying top steel clearances.

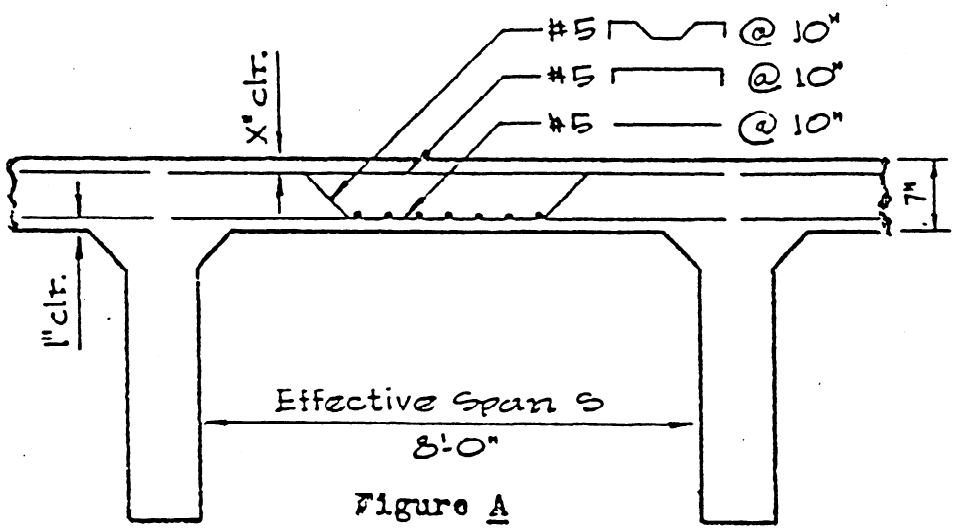


Figure A

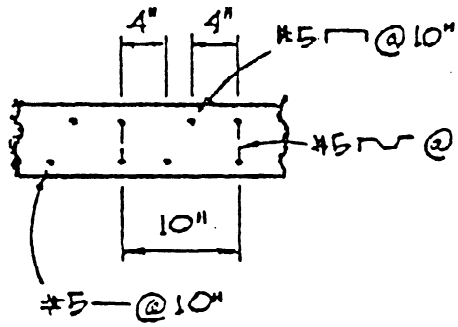


Figure B

4000 psi concrete , Grade 60 rebar

CLEARANCE	D eff	As /ft	Rho	.75 Rho bal	% Mu Cap	% Vu Cap
2	5.75	0.744	0.0107826	0.0214	86	100
2.5	5.25	0.744	0.0118095	0.0214	78	91
3	4.75	0.744	0.0130526	0.0214	70	83
3.5	4.25	0.744	0.0145882	0.0214	61	74
4	3.75	0.744	0.0165333	0.0214	53	65
4.5	3.25	0.744	0.0190769	0.0214	45	57
5	2.75	0.744	0.0225455	0.0214	*	*

Note when the clearance exceeds 4 .5 in. requirements for a ductile section are not met.

MATERIAL SPECIFICATIONS FOR REINFORCING BARS (Cont.)

IDENTIFICATION MARKS* - ASTM STANDARD BARS

The ASTM specifications for billet-steel, rail-steel, axle-steel and low-alloy reinforcing bars (A 615, A 616, A 617 and A 706, respectively) require identification marks to be rolled into the surface of one side of the bar to denote the producer's mill designation, bar size, type of steel, and minimum yield designation. Grade 60 bars show these marks in the following order.

1st - Producing Mill (usually a letter)

2nd - Bar Size Number (#3 through #18)

3rd -Type of Steel: S for Billet meeting supplementary requirement (S 1) of (A 615)

N for Billet (A 615)

R for Rail (A 616) meeting bend test requirements of ASTM A 617, Grade 60 [per ACI 318-83]

for Rail (A 616)

A for Axle (A 617)

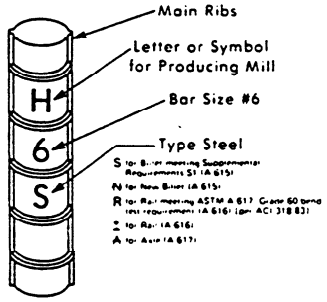
W for Low-Alloy (A 706)

4th - Minimum Yield Designation

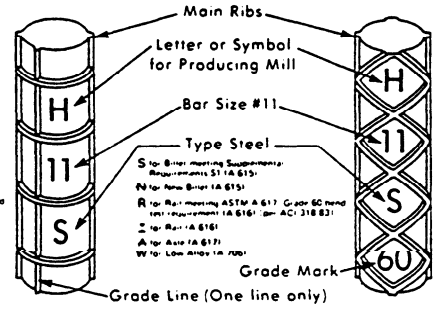
Minimum yield designation is used for Grade 60 bars only and may be either-one single longitudinal line (grade line) or the number 60 (grade mark).

A grade line is smaller and is located between the two main ribs which are on opposite sides of all bars made in the United States. A grade line must be continued through at least 5 deformation spaces, and it may be placed on the side of the bar opposite the bar marks. A grade mark is the 4th mark on the bar.

Grade 40 and 50 bars are required to have only the first three identification marks (no minimum yield. designation).



GRADE 40 AND 50



GRADE 60 AND A 706

VARIATIONS: Bar identification marks may also be oriented to read horizontally (at 90° to those illustrated above).
Grade mark numbers may be placed within separate consecutive deformation spaces to read vertically or horizontally.

ACI BUILDING CODE - REQUIREMENTS FOR REINFORCING BARS

The current ACI Building Code requires billet-steel reinforcing bars to conform to the ASTM A 615 specification including supplementary requirement (S1). As shown in the table on page 1-2 and in the reprint of A 615 in Appendix B, the supplementary requirement (S1) prescribes more-restrictive bend tests for bar sizes #3-#5 in Grades 40 and 60, and for bar sizes #7-#11 in Grade 60; and requires bend tests of #14 and #18 bars. S1 also requires that tensile properties be determined from tests on full-size bars. In other: words, tensile tests of full-size #11, #14, and #18 bars in Grade 60 are required -tensile tests of reduced section specimens for these bar sizes are not permitted. And as indicated above, A 615 reinforcing bars furnished to the supplementary requirement (S1) must be designated for type of steel by the symbol "S" instead of the traditional "N"[1].

Rail-steel reinforcing bars (A 616) must be bend tested, and meet the bend test requirements for axle-steel bars (A 617), Grade 60. As shown above, the Code also requires that the bar markings rolled into the surface of the bars include the letter "R" to designate rail-steel meeting the special bend test requirements.

The ACI Code does not have special requirements for axle-steel (A 617) and low-alloy (A 706) reinforcing bars, nor take any exceptions to the ASTM specifications for these bars.

[1]**See Appendix A for complete identification** marks of concrete reinforcing bars produced by all U.S. manufacturers. The marks, listed **alphabetically by producing mill. include the identification requirements of** ASTM **and the deformation pattern used by each mill.**

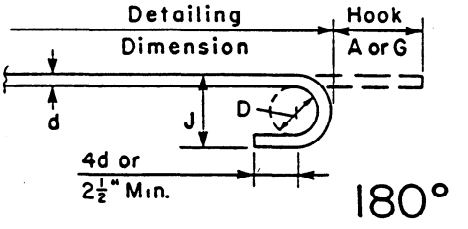
STANDARD HOOKS

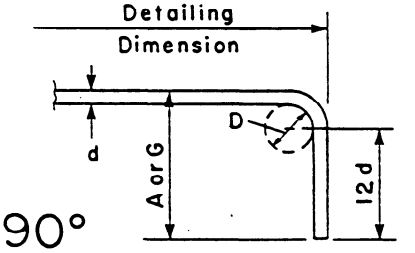
All specific sizes recommended by CRSI below meet minimum requirements of ACI 318-83

RECOMMENDED END HOOKS
All Grades

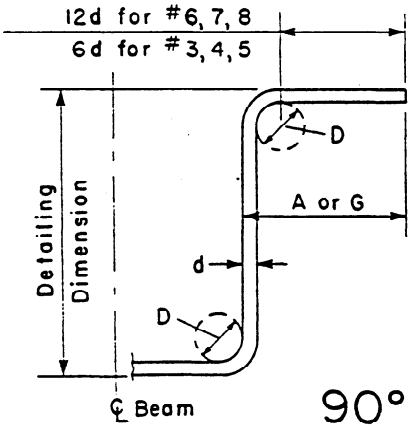
D=Finished bend diameter

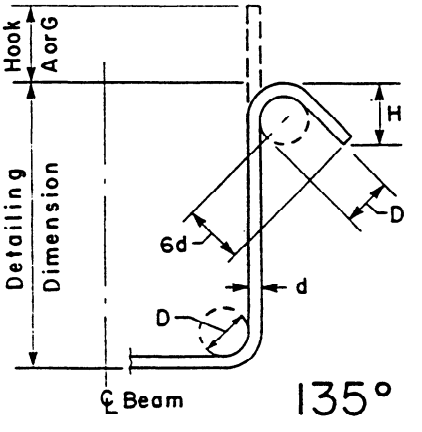
Bar Size	180° HOOKS			90° HOOKS
	D	A or G	J	A or G
# 3	2¼	5	3	6
# 4	3	6	4	8
# 5	3¾	7	5	10
# 6	4½	8	6	1-0
# 7	5¼	10	7	1-2
# 8	6	11	8	1-4
# 9	9½	1-3	11¾	1-7
#10	10¾	1-5	1-1¼	1-10
#11	12	1-7	1-2¾	2-0
#14	18¼	2-3	1-9¾	2-7
#18	24	3-0	2-4½	3-5



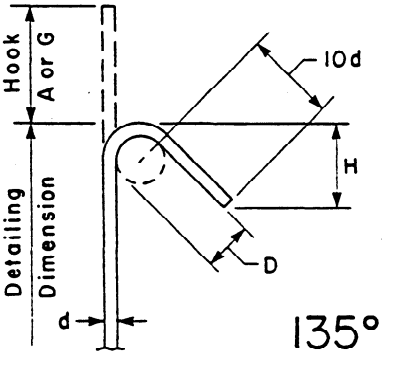


STIRRUP AND TIE HOOKS





135° SEISMIC STIRRUP/TIE HOOKS



STIRRUPS
(TIES SIMILAR)

STIRRUP AND TIE HOOK DIMENSIONS
Grades 40-50-60 ksi

Bar Size	D (in.)	90° Hook	135° Hook	
		Hook A or G	Hook A or G	H Approx.
#3	1½	4	4	2½
#4	2	4½	4½	3
#5	2½	6	5½	3¾
#6	4½	1-0	7¾	4½
#7	5¼	1-2	9	5¼
#8	6	1-4	10¼	6

135° SEISMIC STIRRUP/TIE
HOOK DIMENSIONS
Grades 40-50-60 ksi

Bar Size	D (in.)	135° Hook	
		Hook A or G	H Approx.
#3	1½	5	3½
#4	2	6½	4½
#5	2½	8	5½
#6	4½	10¾	6½
#7	5¼	1-0½	7¾
#8	6	1-2¼	9

NOTES:
1. 180° hook J dimension (sizes #10, #11, #14 and #18), and A or G dimension (#14 and #18) have been revised to reflect recent test research using ASTM/ACI bend test criteria as a minimum.
2. Tables for Stirrup and Tie Hook dimensions have been expanded to include sizes #6, #7, and #8 to reflect current design practices.

CHAPTER 8

RECOMMENDED INDUSTRY PRACTICE - FIELD ERECTION

PLACING REINFORCING BARS*

These recommendations for placing reinforcing bars are based upon the ACI Building Code.

1. GENERAL

Reinforcing bars should be accurately placed in the positions shown on design drawings and adequately tied and supported before concrete is placed, and secured against displacement within the tolerances recommended in Section 7.

Welding of crossing bars (tack welding) should not be permitted for assembly of reinforcement unless authorized by the Engineer.

2. SURFACE CONDITION OF REINFORCEMENT

At the time of concrete placement, all reinforcing bars should be free of mud, oil, or other deleterious materials. Reinforcing bars with rust, mill scale, or a combination of both should be considered as satisfactory, provided the minimum dimensions, weight, and height of deformations of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

3. BENDING

Reinforcing bars should not be bent or straightened in a manner that will injure the material. Bars with kinks or improper bends should not be used. No bars partially embedded in concrete should be field bent, except as shown on the design drawings or permitted by the Engineer.

4. SPACING OF REINFORCEMENT

The clear distance between parallel reinforcing bars in a layer should not be less than the nominal diameter of the bars, nor 1 in. Clear distance should also not be less than one and one-third times the nominal maximum size of the coarse aggregate, except if in the judgement of the Engineer, workability and methods of consolidation are such that concrete. can be placed without honeycomb or voids.

Where parallel reinforcement is placed in two or more layers, the bars in the upper layers should be placed directly above those in the bottom layer with the clear distance between layers not less than 1 in.

-Groups of parallel reinforcing bars bundled in contact, assumed to act as a unit, not more than four in any one bundle may be used only when stirrups or ties enclose the bundle. Bars larger than #11 should not be bundled in beams or girders. Individual bars in a bundle cut off within the span of flexural members should terminate at different points with at least 40 bar diameters stagger. Where spacing limitations and minimum clear cover are based on bar size, a unit of bundled bars should be treated as a single bar of a diameter derived from the equivalent total area.

In walls and slabs other than concrete joist construction, the principal reinforcement should not be spaced farther apart than three times the wall or slab thickness, nor more than 18 in.

In spirally reinforced and tied columns, the clear distance between longitudinal bars should not be less than one and one-half times the nominal bar diameter, nor 1 1/2 in.

The clear distance limitation between bars should also apply to the clear distance between a contact lap splice and adjacent splices or bars.

5. SPLICES IN REINFORCEMENT**

(a) GENERAL. Splicing of reinforcing bars should be either by lapping, welding, or by mechanical connections.

Splices of reinforcing bars should be made only as required or permitted on the design drawings or in the specifications, or as authorized by the Engineer. All welding should conform to the current edition of "Structural Welding Code - Reinforcing Steel" (AWS D1.4).

(b) LAP SPLICES. Lap splices of #14 and #18 bars should not be used, except in compression only to #11 and smaller bars.

Lap splices of bundled bars should be based on the lap splice length recommended for individual bars of the same size as the bars spliced, and such individual splices within the bundle should not overlap each other. The length of lap should be increased 20 percent for a 3-bar bundle and 33 percent for a 4-bar bundle.

Bar laps placed in contact should be securely wired together in such a manner as to maintain the alignment of the bars and to provide minimum clearances.

Bars spliced by noncontact lap splices in flexural members should not be spaced transversely farther apart than one-fifth the required length of lap nor 6 in.

(c) WELDED SPLICES. A full welded splice is one in which the bars are butted and welded to develop in tension at least 125 percent of the specified yield strength of the bar.

(d) MECHANICAL CONNECTIONS. Mechanical splice devices should be installed in accordance with the manufacturers' recommendations.

A full mechanical connection is one in which the bars are connected to develop in tension or compression at least 125 percent of the specified yield strength of the bar.

6. EMBEDMENT AND EXTENSIONS

(a) Bottom reinforcing bars in beams should extend at least 6 in. into the support. Bottom bars in slabs or joists should extend into the support to the limits of the specified cover or 6 in., whichever is less.

(b) Generally, in one-way continuous construction, unless otherwise called for on the drawings, the top rein-

*For more complete recommendations on *bar* placement, *see* Placing *Reinforcing Bars* available from the Concrete Reinforcing Steel Institute. -
***See Reinforcement Anchorages and Splices* by the Concrete Reinforcing Steel Institute.

forcing bars should extend into adjacent spans to a point three-tenths (0.30) of the greater clear span length beyond the far face of the support. Generally at discontinuous ends, top bars should extend into-the span at least one quarter (0.25) of the clear span length beyond the face of the support and extend into the support to the specified cover at the outer faces of the members into which they frame.

7. TOLERANCES IN PLACEMENT

Unless otherwise specified, reinforcing bars should be placed within the following tolerances:

(a) Tolerance for depth, and minimum clear concrete cover in flexural members, walls and columns should be as follows:

	Tolerance on d	Tolerance on minimum concrete cover
$d \leq 8$ in.	± 3/8 in.	−3/8 in.
$d > 8$ in.	± 1/2 in.	−1/2 in.

Except that the tolerance for the clear distance to formed soffits should be - 1/4 in., and the tolerance for cover should not exceed minus one-third of the minimum cover required on the design drawings or in the specifications.

Note: "d" is the specified effective depth.

(b) Tolerance for logitudinal location of bends and ends of bars should be ±2 in. except at discontinuous ends of members where the tolerance should be 2 1/2 in.

(c) As long as the total number of bars specified is maintained, a reasonable tolerance in spacing individual bars is ± 2 in., except where openings, inserts, embedded items, etc., might require some additional shifting of bars.

(d) Tolerance for length of laps in lap splices should be ± 1 in.

(e) Tolerance for embedded length should be 2 1 in. for #3 through #11 bars, and -2 in. for #14 and #18 bars.

8. SUPPORTS

The use of bar supports should follow the industry practices presented in Chapter 3 of this Manual, except as noted on the contract drawings.

Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete should not be permitted.

The required positioning of supports in post-tensioned construction to provide proper tendon profile should be in accordance with the placing drawings provided by the post-tensioning contractor and approved by the Engineer. The sequence of placing reinforcing bars in conjunction with tendons and/or ducts should be the responsibility of the Engineer.

9. CONCRETE PROTECTION FOR REINFORCEMENT

The following minimum concrete cover should be provided for reinforcing bars. For bundled bars, the minimum cover should be equal to the equivalent diameter of the bundle but need not be greater than 2 in.; except for concrete cast against and permanently exposed to earth, the minimum cover should be 3 in.

(a) CAST-IN-PLACE CONCRETE (nonprestressed)

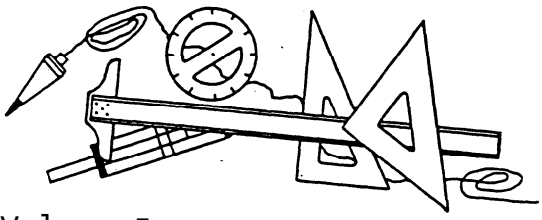
	Minimum cover, in.
Concrete cast against and permanently exposed to earth	3
Concrete exposed to earth or weather:	
#6 through #18 bars	2
#5 bars, W31 or 031 wire, and smaller	1½
Concrete not exposed to weather or in contact with the ground:,	
Slabs, walls, joists:	
#14 and #18 bars	11/2
#11 bars and smaller	3/4
Beams, girders, columns:	
Primary reinforcement, ties, stirrups or spirals	1 1/2
Shells and folded plate members:	
#6 bars and larger	3/4
#5 bars, W31 or D31 wire, and smaller	1/2

(b) PRECAST CONCRETE (manufactured under plant control conditions)

	Minimum cover, in.
Concrete exposed to earth or weather;	
Wall panels:	
#14 and #18 bars	1 1/2
#11 bars and smaller	3/4
Other members:	
#14 and #18 bars	2
#6 through #11 bars	1 1/2
#5 bars, W31 or 031 wire, and smaller	1 1/4
Not exposed to weather or in contact with the ground:	
Slabs, walls, joists	
#14 and #18 bars	1 1/4
#11 bars and smaller	5/8
Beams, girders, columns:	
Primary reinforcement	d_b but not less than than 5/8 need not exceed 1 1/2
Ties, stirrups, or spirals	3/8
Shells and folded plate members:	
#6 bars and larger	5/8
#5 bars, W31 or 031 wire, and smaller	3/8

(c) In corrosive atmospheres or severe exposure conditions, the amount of concrete protection should be suitably increased, and the denseness and nonporosity of the protecting concrete should be considered, or other protection should be provided.

APPENDIX 4



Volume I

BRIDGE CONSTRUCTION MEMO 2-4.0

MISCELLANEOUS INFORMATION AND INSTRUCTIONS

October 7, 1985

BRIDGE DECK CONTOURS AND GEOMETRICS

Plans prepared by the Office of Structure Design contain a "20" scale deck contour plot. A memo in the R.E. Pending File will advise the Structure Representative that he may obtain a 4-scale plot of the contoursupon request. (Attachment #1 of this Bridge Construction Memo is a sample of DS-D134 (Rev. 9/85) which is placed in the R.E. pending File). Structure Representatives wanting 4-scale contour plots should enter the required information on the DS-0134 and return it to the Chief, Office of Structure Construction.

For jobs which do not include a "20" scale deck contour plot in the contract plans, it will be the Structure Representative's responsibility to prepare needed 4-scale contour plots. The Structure Representative may elect one of the following methods to prepare a 4-scale plot of the deck contours:

1. Hand-draw 4-scale contour plots on the job.

2. Submit input information to obtain 4-scale contour plots through the computer program (computer program 2-4, "Bridge Deck Geometric").

3. Submit a written request to the Chief, Office of Structure Construction requesting that the 4-scale contour plot be prepared and furnished by the Office of Structure Design. This request should give the following information: Bridge name and number; Design Group as shown on the plans; Number of blue-line copies needed for each structure.

Date:

Project:

To: Office of Structure Construction
R. E. Pending File

The Computer data for the following bridges on the above project are on file with the Office of Structures Design, Design Section_____ in Sacramento.

We will send you "d-scale" computer printouts of the Deck Contours at your request.

SR ✓	Bridge Name	Bridge Number

Project Engineer

SR: Return this form to:

Chief,Office of Structure Construction
P.0. Box 942874
Sacramento, CA 94274-0001

It is requested that the original and _____ "blue line" copies of the Deck Contours for the structures checked above be sent to me at the following address:

Structure Representative

Falsework Release Instructions

(For cast-in-place concrete girders only)

FALSEWORK RELEASE

Alternative 1:

Falsework shall be released as soon as permitted by the specifications. Closure pour shall not be placed sooner than 60 days after the falsework has been released.

Alternative 2:

Falsework shall not be released less than 28 days after the last concrete has been placed. Closure pour shall not be placed sooner than 14 days after the falsework has been released.

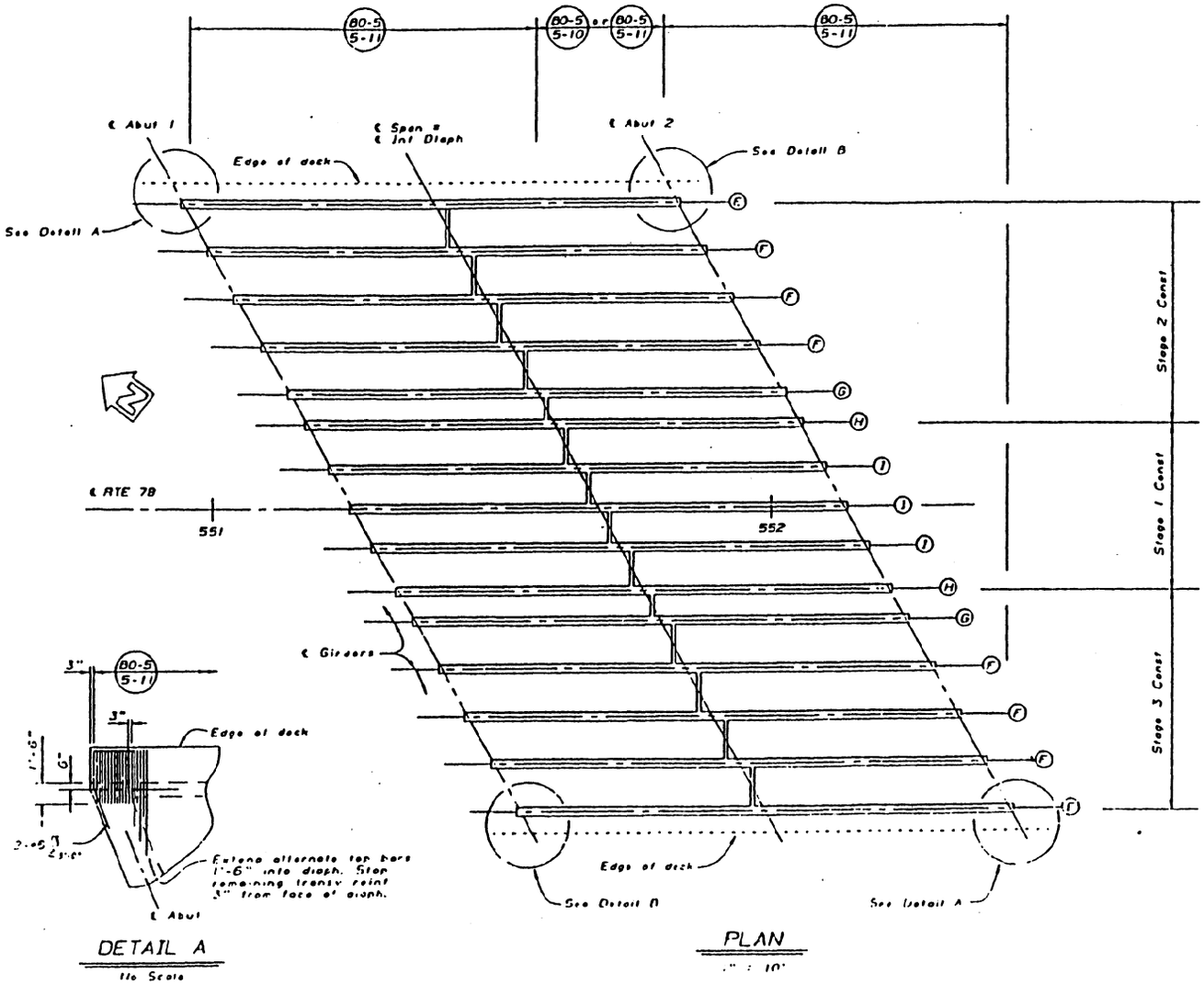
When Falsework Release Alternative 2 is used, camber values are 0.75 times those shown.

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	78			

REGISTERED ENGINEER - CIVIL

W.J. CULLEN
No. 040820
Exp. 3-31-91
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE



PLAN

DETAIL A

No Scale

PRESTRESSING NOTES

Working Force: The force required at center of span after all losses.

Concrete Strength: f'ci is at time of initial stressing. f'c is at 28 days, psi.

Camber: Girder camber immediately after the deck and barriers have been placed.

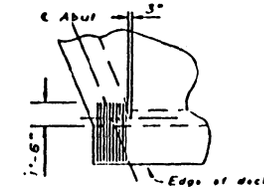
Screed line elevations for deck concrete will be determined by the Engineer.

Contractor may interpolate "P" and "X" values between limits shown, as approved by the Engineer.

GIRDER DESIGNATION AND LENGTH	P=WORKING FORCE IN KIPS "X"		CONCRETE STRENGTH f'ci	f'c	GIRDER CAMBER @ ℄ SPAN
E	4"	920	5000	5700	-0.03'
89'-9"	6"	1000	5000	5700	-0.02'
FG	4"	870	6000	6000	-0.01'
89'-9"	6"	920	5800	5800	-0.02'
HI	4"	810	5400	5800	-0.03'
89'-9"	6"	840	5300	5800	-0.01'

NOTE:

Camber values are based on 9 weeks elapsed time between stressing girders and placing of deck.



DETAIL B

No Scale

DESIGN	R.L. Gage		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	57-303 9-85
DETAILS					
QUANTITIES		Mark Dent			

SMILAX DR UC - REPLACE

GIRDER LAYOUT

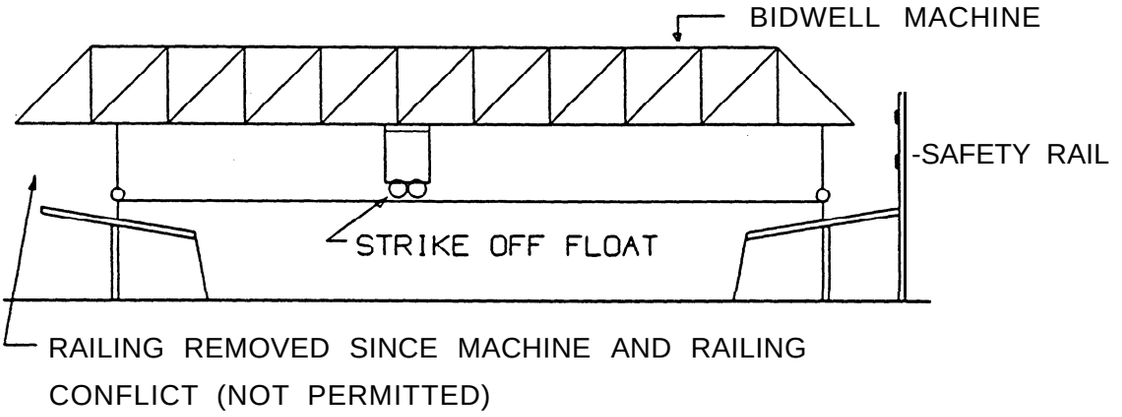
CU 11
EA 110071

14 | 18

BRIDGE DECK SAFETY

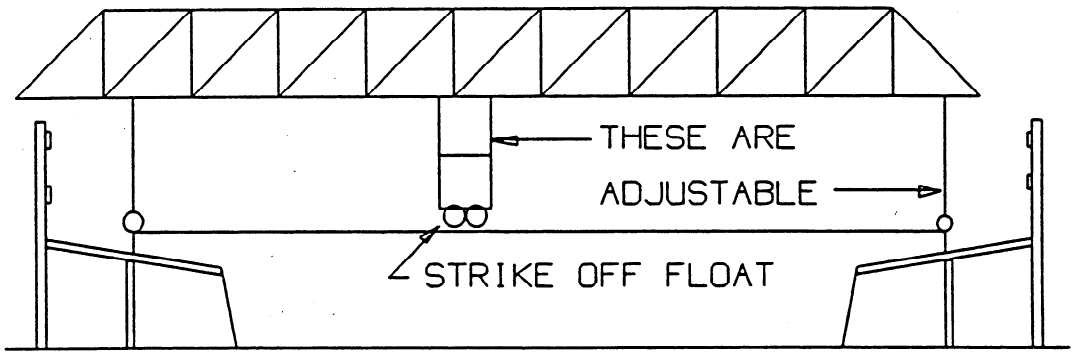
Frequently the Contractor will want to remove the safety railings along the edge of deck if they conflict with his deck finishing machine. Deck finishing machines usually come in sections approximately 10 feet. If the width of the bridge deck is say 32 feet, then the machine must be made up of 4 sections or 40 feet. This meansthat 8 feet must hang over one side of the bridge or the other. Since the machine may not be high enough to pass over the top of the railings, the Contractor may want to remove a portion of the safety rail. See Figure 1.

FIGURE 1



One solution to this problem is shown in Figure 2. The legs of these machines are adjustable and will allow the machine to be elevated high enough to pass over the top safety railings eliminating the need to remove the railings. The strike off float must be lowered to make up the difference. This can be accomplished on most modern Bidwell machines without any modifications or problems.

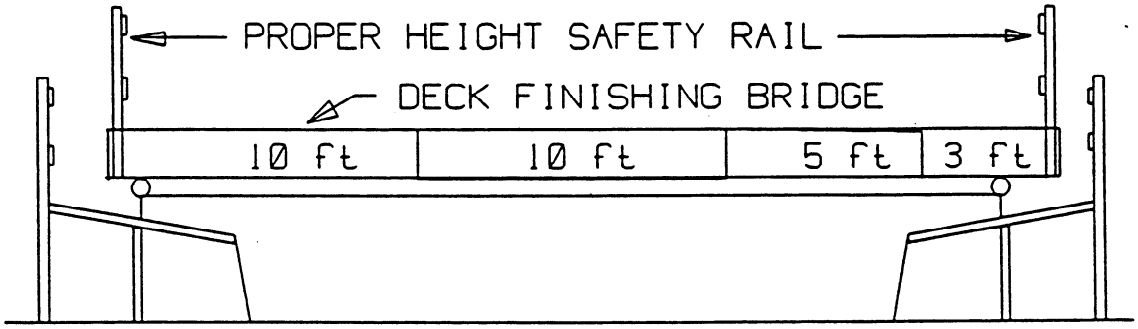
FIGURE 2



NO NEED TO REMOVE RAILINGS WITH MACHINE ELEVATED

The next problem we encounter is with the deck finishing bridges. These are the bridges which span the freshly placed concrete immediately behind the deck finishing machine. Older finishing bridges come in 10 feet sections that can not be raised to clear the safety railings. This problem can be solved by having shorter sections made up, say a five footer and a two or three footer, as shown in Figure 3.

FIGURE 3

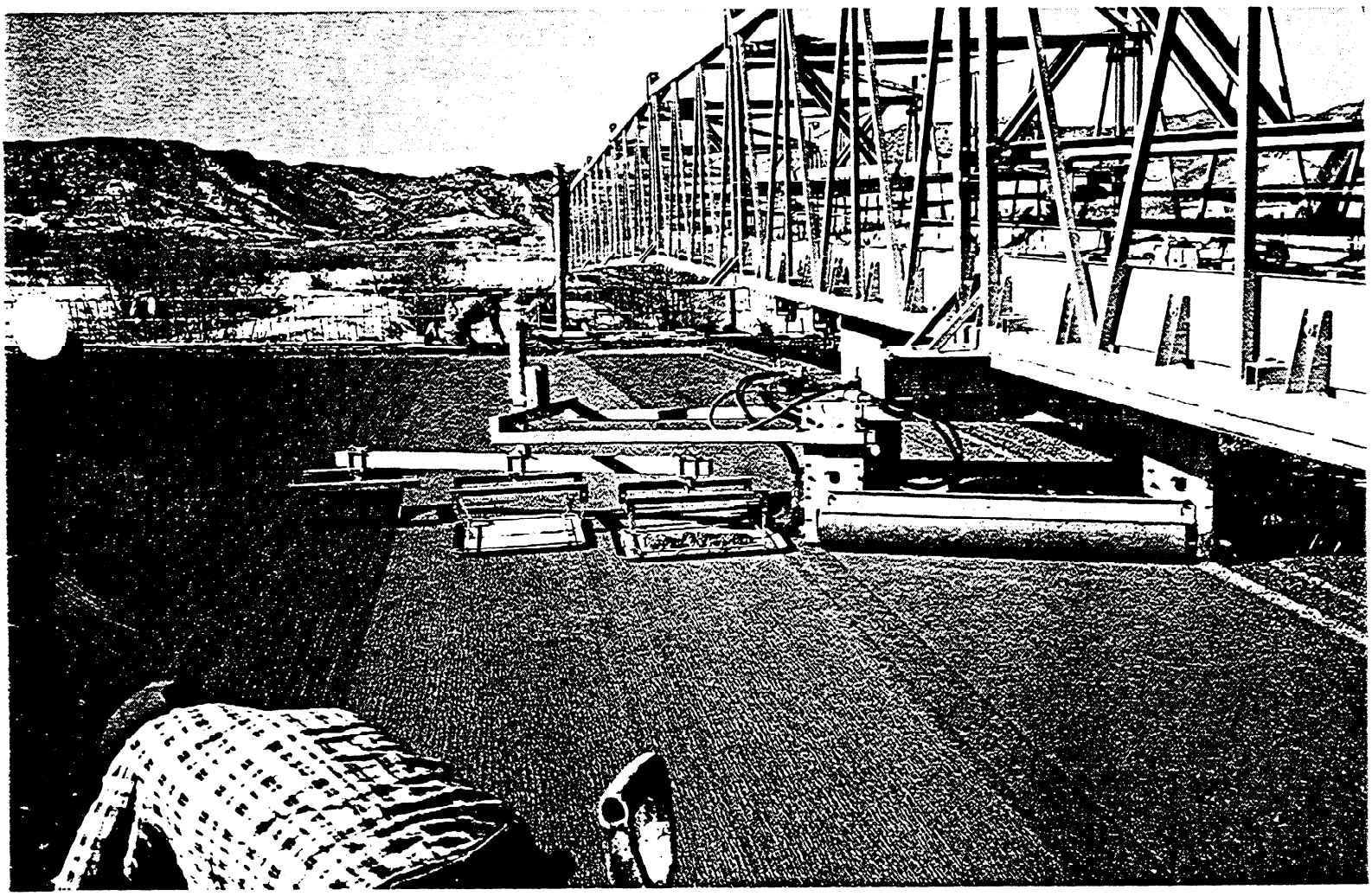


Most modern finishing bridges are internally telescopic which allows them to be adjusted to almost any width. Another problem with finishing bridges is that the safety railings are no longer 42 inches high to the men on the finishing bridges. It is probably more like 16 inches from the top of the finishing bridge to the top of the safety railings. This means that the Contractor needs to make up metal brackets which will hold a 42 inches high safety rail to the ends of the finishing bridge.

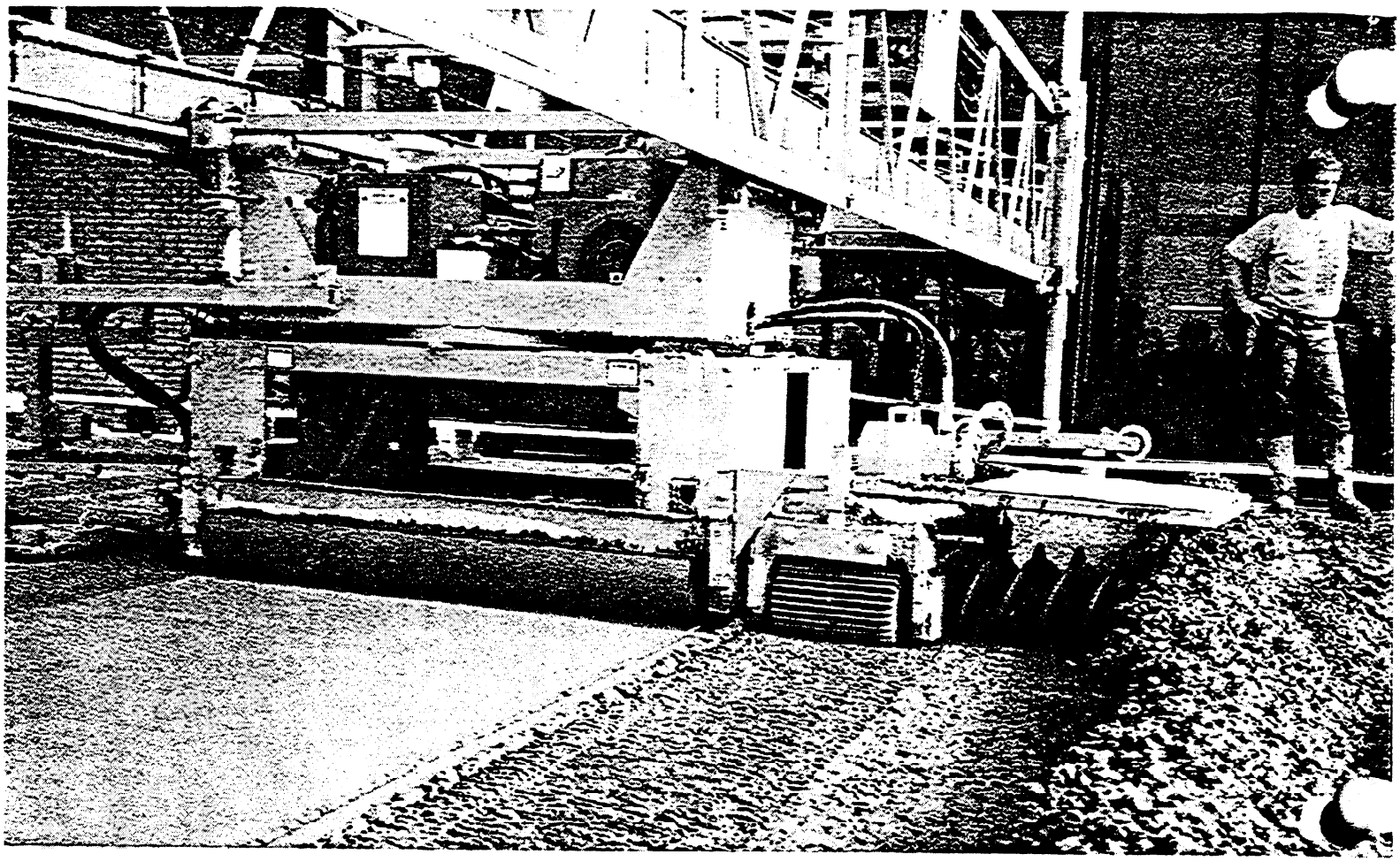
BID-WELL®

CONCRETE FINISHERS

BRIDGE DECKS • OVERLAYS
STREETS • CANALS



HIGHEST PRODUCTION
BEST CONCRETE FINISH
MOST VERSATILE MACHINE



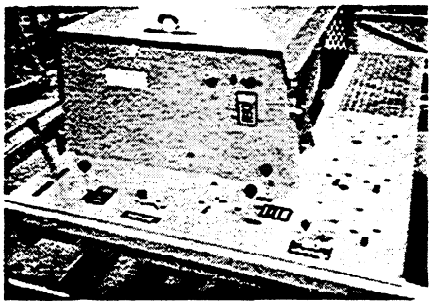
These features give the BID-WELL its finishing superiority

The Bid-Well Roller Finisher produces a finished concrete surface of superior quality. at a high production rate, and incorporates exclusive design features that make it the best roller finisher ever offered to the constructron industry.

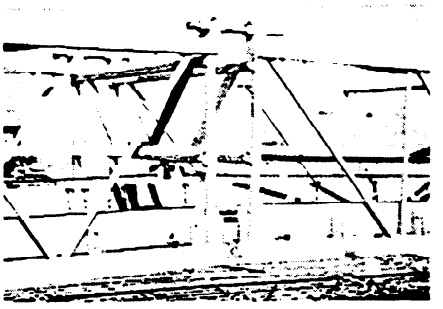
Bid-Well's all-welded steel construction gives you strength with a minimum of weight. The truss sections are pin-connected to give you the fastest set-up time and complete crownability.

1. Rollers automatically reverse direction of rotation or the operator may choose to run one roller in the opposite direction to finish concrete on each carnage pass
   This seals the surface and gives you a smoother finish.
2. Adjustable dual. augers strike off and plow excess concrete forward on every pass. The exclusive quick auger height adjustment feature leaves the proper amount of concrete for the roller to finish for all slumps.
   This gives you better product/on. reduces labor.
3. Reversible dual rollers give twice the finishing action. They also finish to the curb steel on bridge decks. to an existing curb for overlay work. or over the forms for paving.
   This speeds up production and gives a better finish.
4. As each finishing pass is completed. the machine moves forward automatically to reposition the roller for the next finishing pass A patented B -Well feature.
   This gives maximum Juction with the roller continuously finishing.
5. Power is supplied by two interchangeable 14 HP (10.4KW). 16HP (11.9KW). 20HP (14.9KW). or 23HP (17.2KW) Kohler air-cooled engines.
6. Complete versatility
   - Molds all sections-flat slabs or parabolic, rooftop and inverted crowns. Bid-Well's simple. efficient crowning system rapidly crowns the truss at any hinge point. This system is patented by Bid-Well. Optional is a powered crown adjuster for on-the-go crown changes. controlled from the operator's console.
   - Finishes tapered slabs of varying widths.
   - Adjusts to finish maximum skews with a 36O° carriage turntable.
   - Finishes severe superelevations or slopes. Reversible finishing rollers can be quickly changed to rotate in one direction only to finish going upgrade on superelevations or finish skews.
   - Meets all specified tolerances, as strict as **1/8"** (3mm) in 20 feet (6 meters).
7. Easy operator control -
   - Operator's seat at the control panel keeps him clear of the carnage movement for maximum efficiency and safety.
   - The operator may stop or reverse the carnage movement at any point.
   - Augers and roller rotation may be controlled stopped from the front Or rear of the machine by a lever located on the carnage.

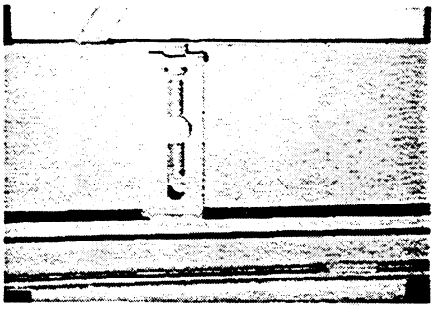
STANDARD FEATURES



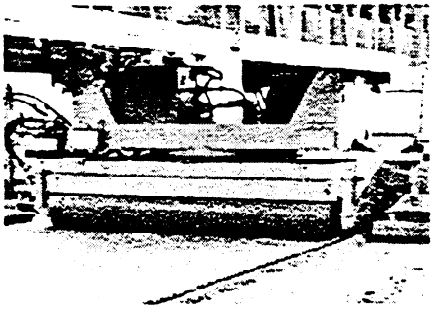
Easy-to-operate control console, showing blanks for optional accessories.



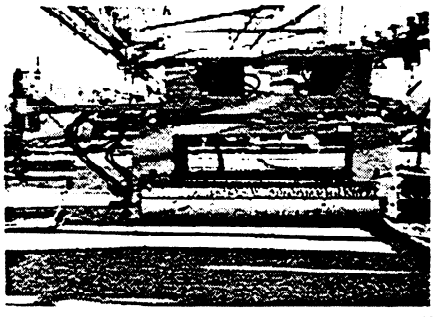
Fast, simple crown adjustment at any hinge point.



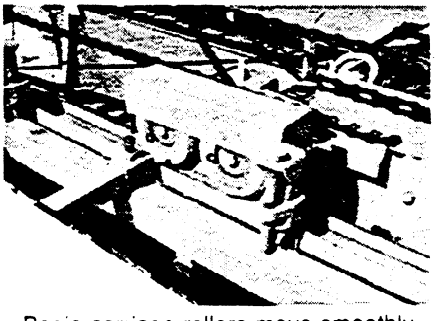
Carriage travel rail adjuster.



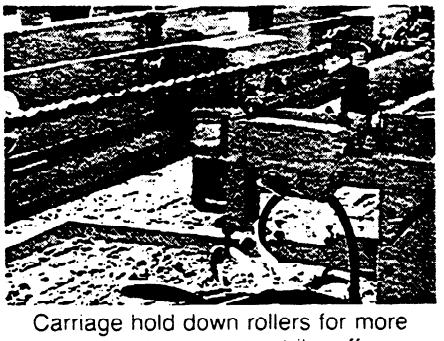
Variable carriage travel speed.



Automatic roller reversal on each pass, if wanted.

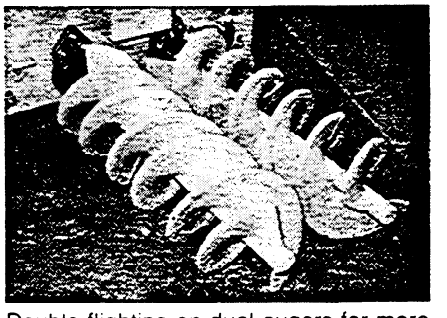


Bogie carriage rollers move smoothly through joints and over crowns.

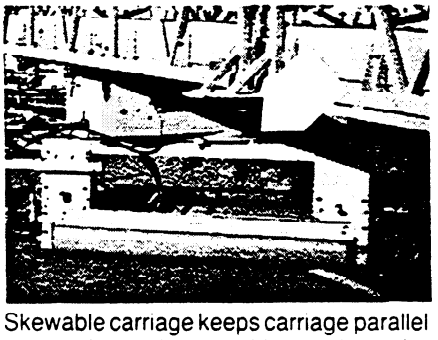


Carriage hold down rollers for more accurate concrete strike-off.

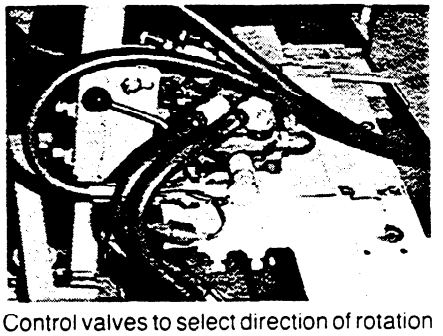
Rapid height adjustment for dual augers.



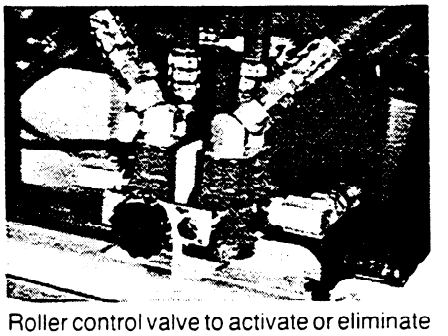
Double flighting on dual augers for more accurate concrete strike-off.



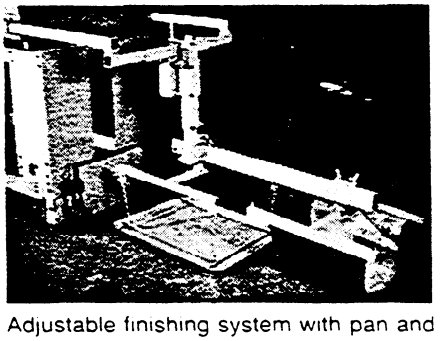
Skewable carriage keeps carriage parallel to roadway when machine is skewed.



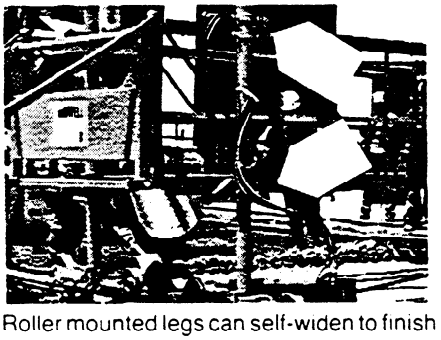
Control valves to select direction of rotation of individual rollers.



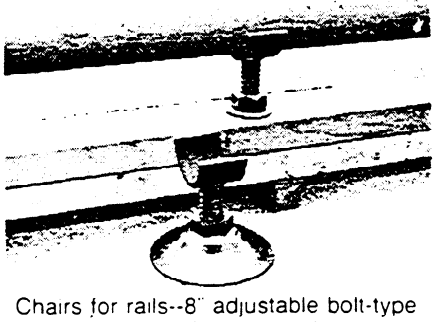
Roller control valve to activate or eliminate reversing action.



Adjustable finishing system with pan and drag.

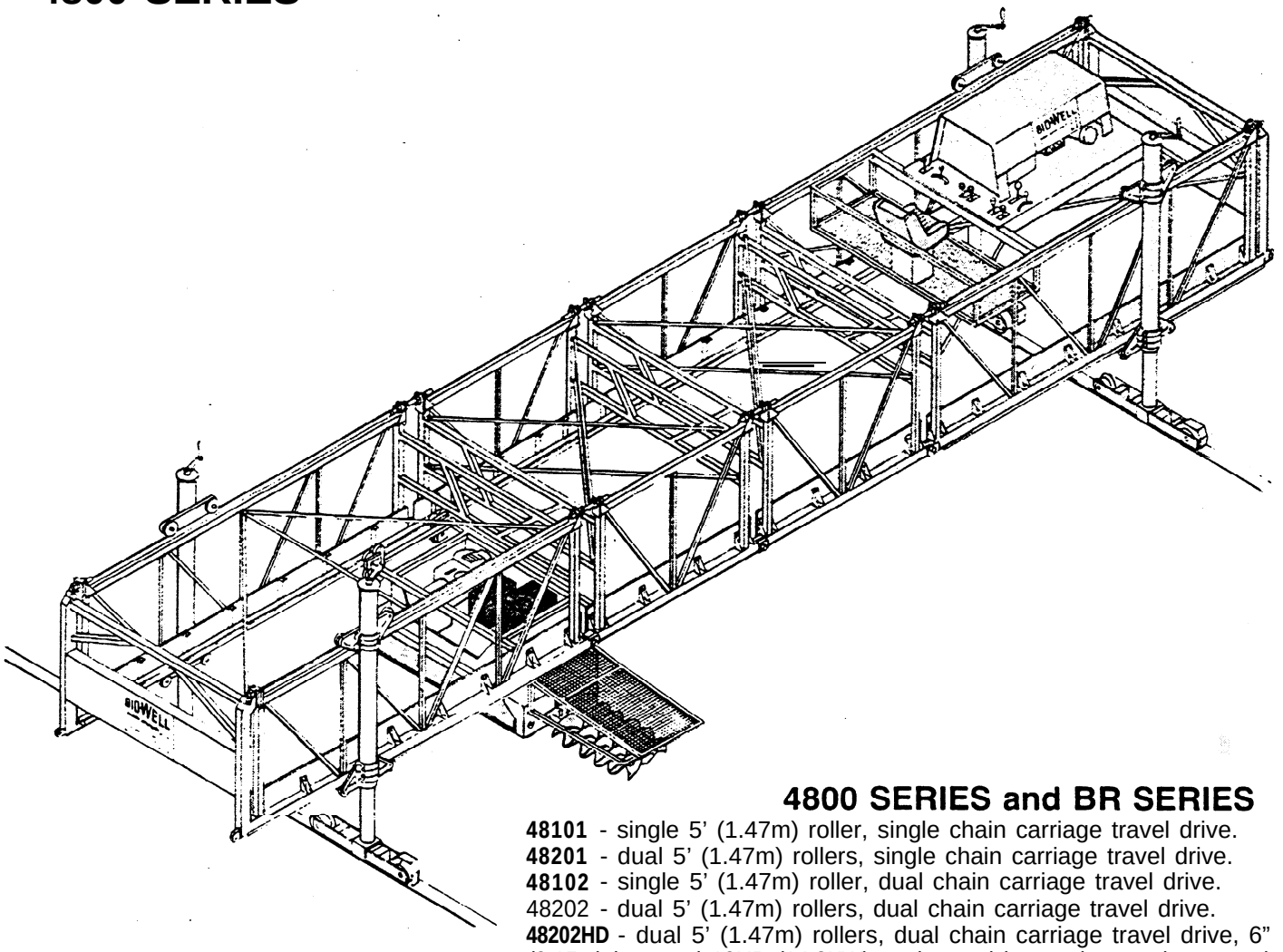


Roller mounted legs can self-widen to finish tapered decks and slabs.



Chairs for rails--8" adjustable bolt-type chair or self-standing chair.

4800 SERIES

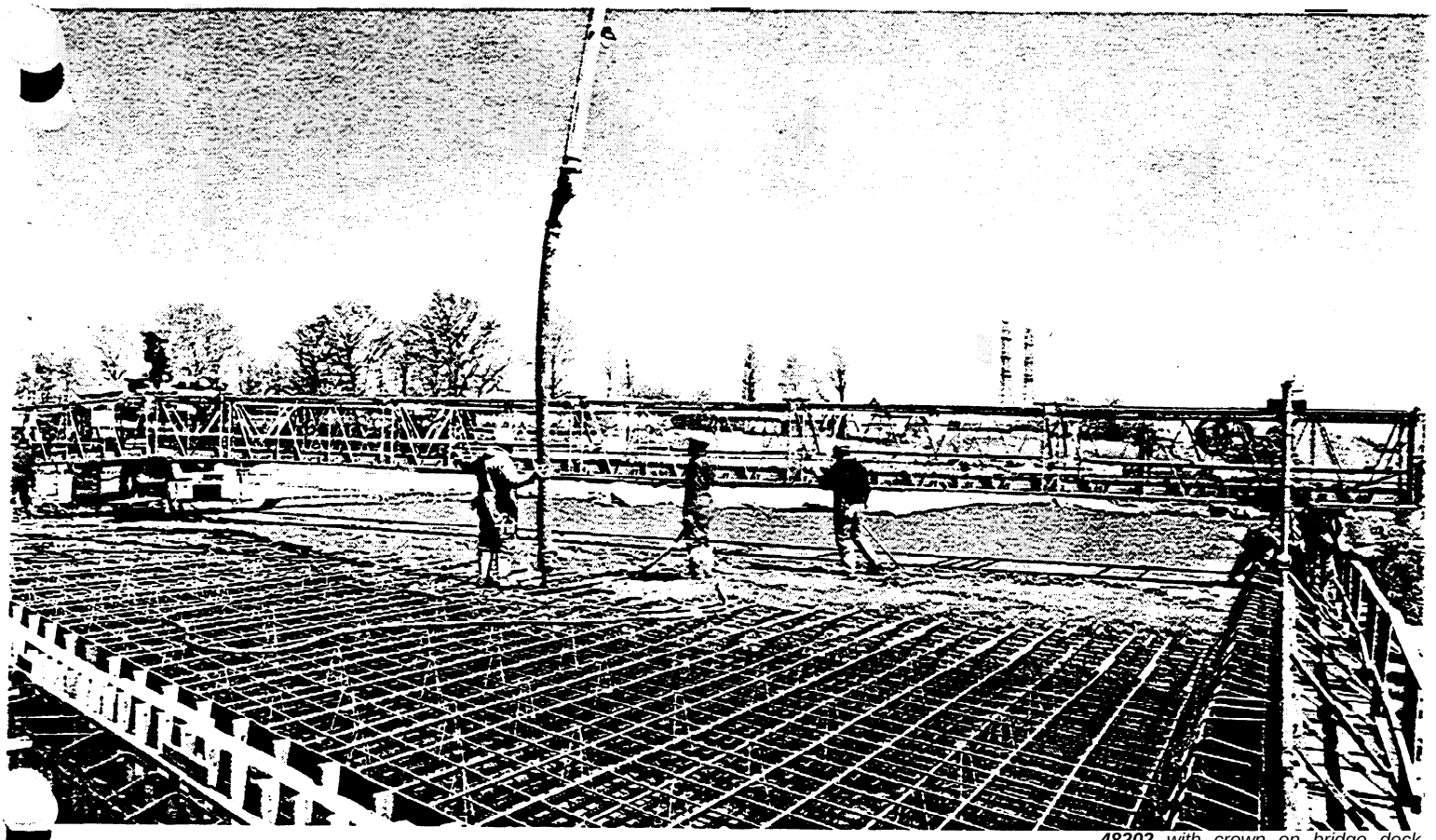


4800 SERIES and BR SERIES

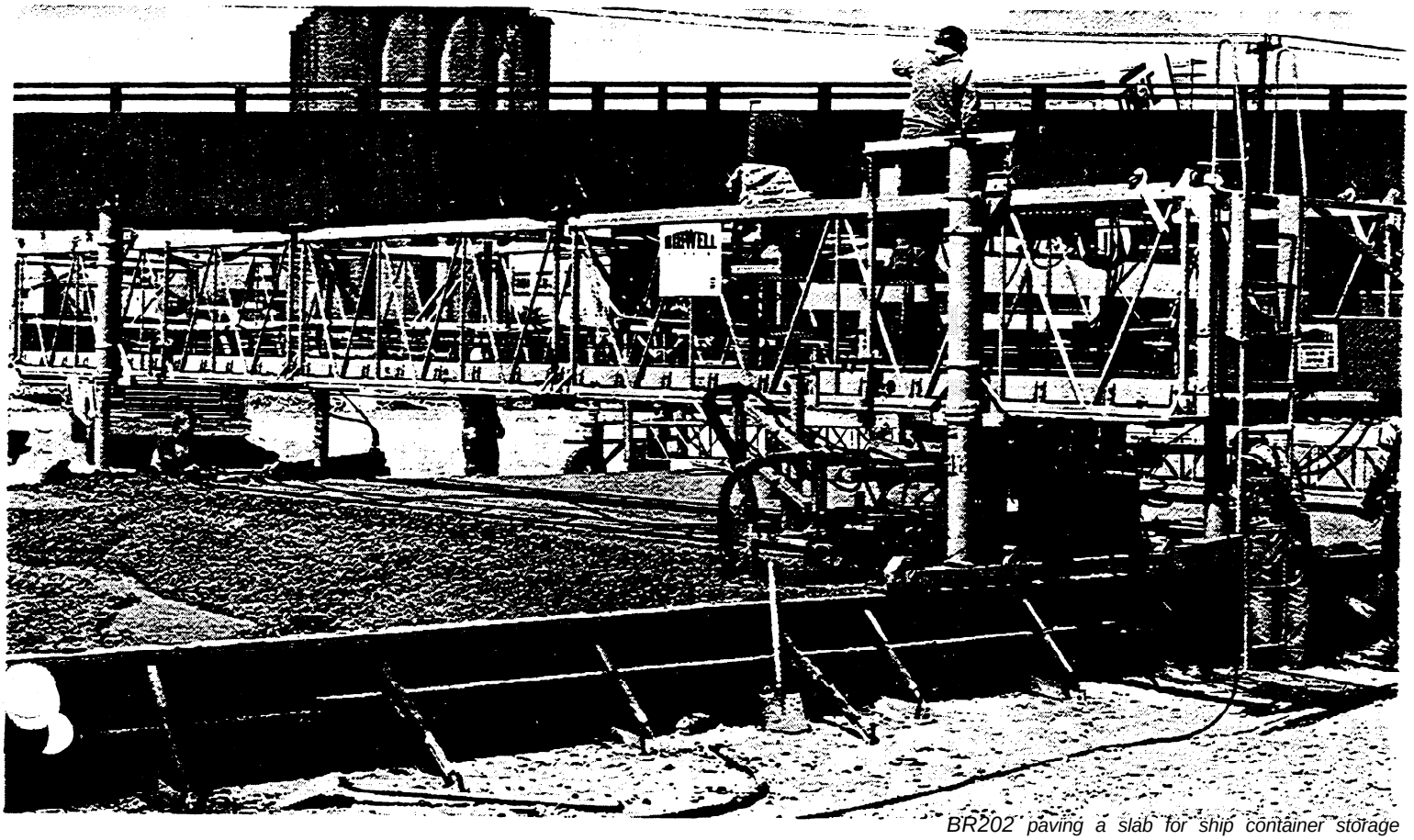
48101 - single 5' (1.47m) roller, single chain carriage travel drive.
48201 - dual 5' (1.47m) rollers, single chain carriage travel drive.
48102 - single 5' (1.47m) roller, dual chain carriage travel drive.
48202 - dual 5' (1.47m) rollers, dual chain carriage travel drive.
48202HD - dual 5' (1.47m) rollers, dual chain carriage travel drive, 6" (0.15m) legs and 19HP (14.2KW) engine and heavy duty carriage travel motor.

SPECIFICATIONS common to the above:

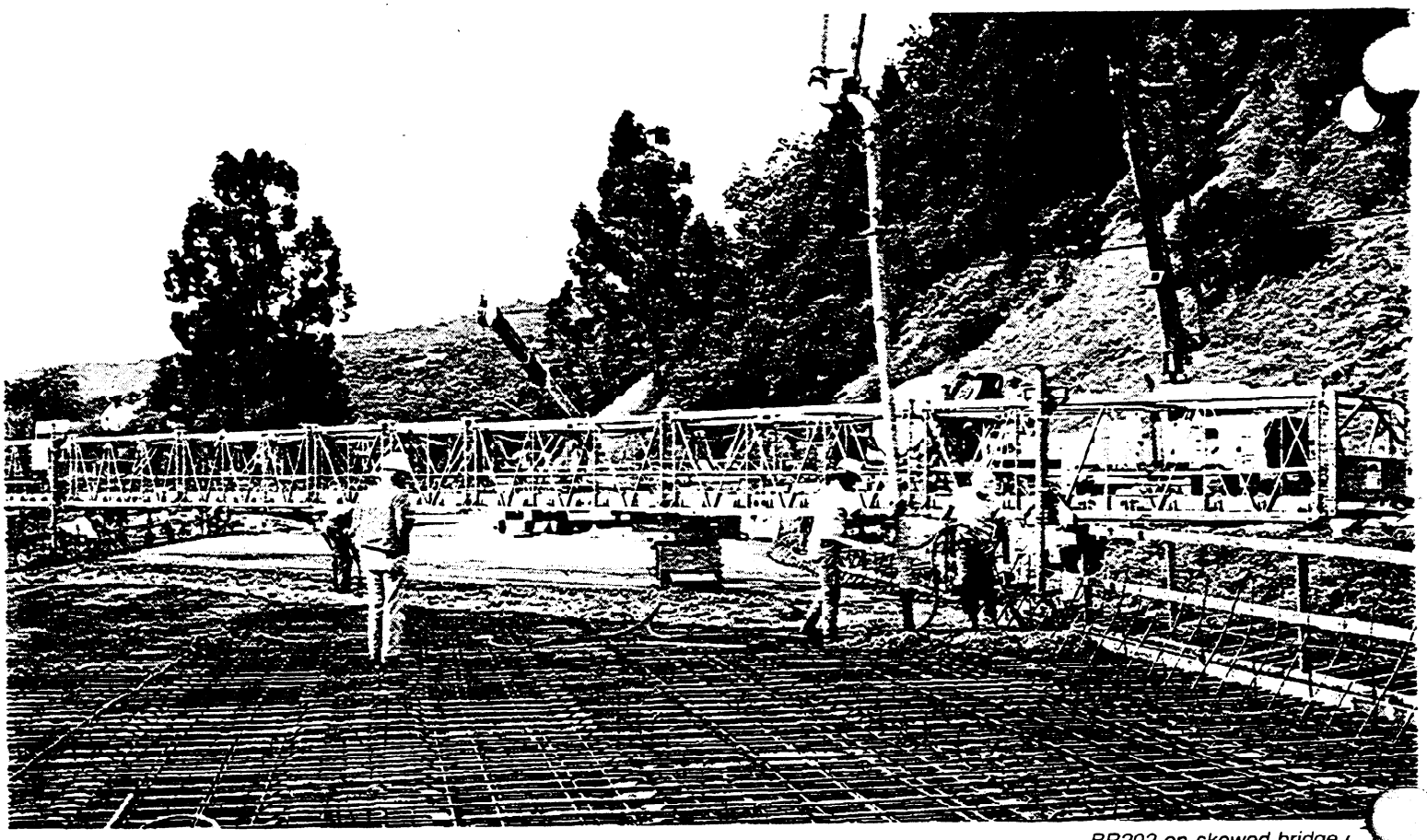
1. Basic 36' (11.Om) unit made up of square end sections, 48*'(1.22m) deep truss.
2. With up to 15' (4.6m) of leg travel on each 18' (5.5m) end section.
3. Crown may be changed at any hinge point or at any travel rail adjuster.
4. By adding 3'(0.9m), 6'(1.8m), 12'(3.7m), 15'(4.6m) or 18'(5.5m) inserts the basic machine can finish 130'(39.6m) wide. No extra overhead truss required.
5. Powered by two 16HP (11.9KW) Kohler air cooled engines, standard (other options available).
6. Dual 24" (0.61 m) quick crank augers with double flighting.
7. Independent roller rotation valve kit with automatic skew cylinder.
8. Variable speed carriage travel up to 80' (24.4m) per minute.
9. Independent hydraulic direct drive motor on each roller.
10. Easy-to-operate control console with swivel seat for operator.
11. Manual override to stop and reverse carriage at any point.
12. Eight bogie rollers on carriage with hold down rollers to prevent floating.
13. Four machine travel bogies with wheels at 48" (1.22m) centers on each bogie on legs 84" (2.13m) (88" (2.23m) on BR series). Making the total span of the wheels 132" (3.35m) in 4800 series (136" (3.45m) in BR series)
14. Crank adjustable finishing pan with astro grass or burlap drag.
15. Flat flanged wheels or concave wheels.
16. Standard carriage travel motor.
17. 4" (0.1Om) heavy duty legs.



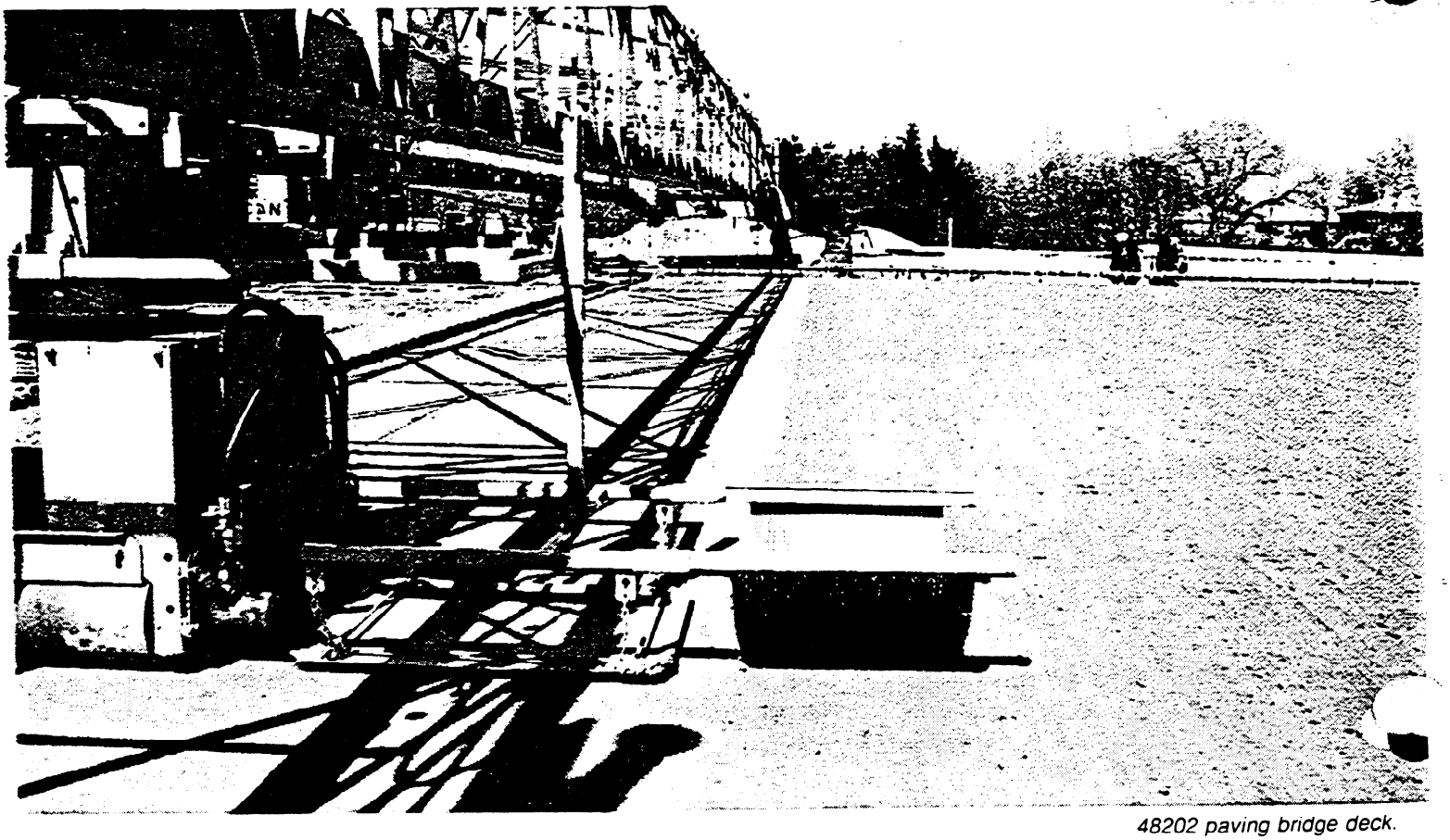
***48202** with crown on bridge deck*



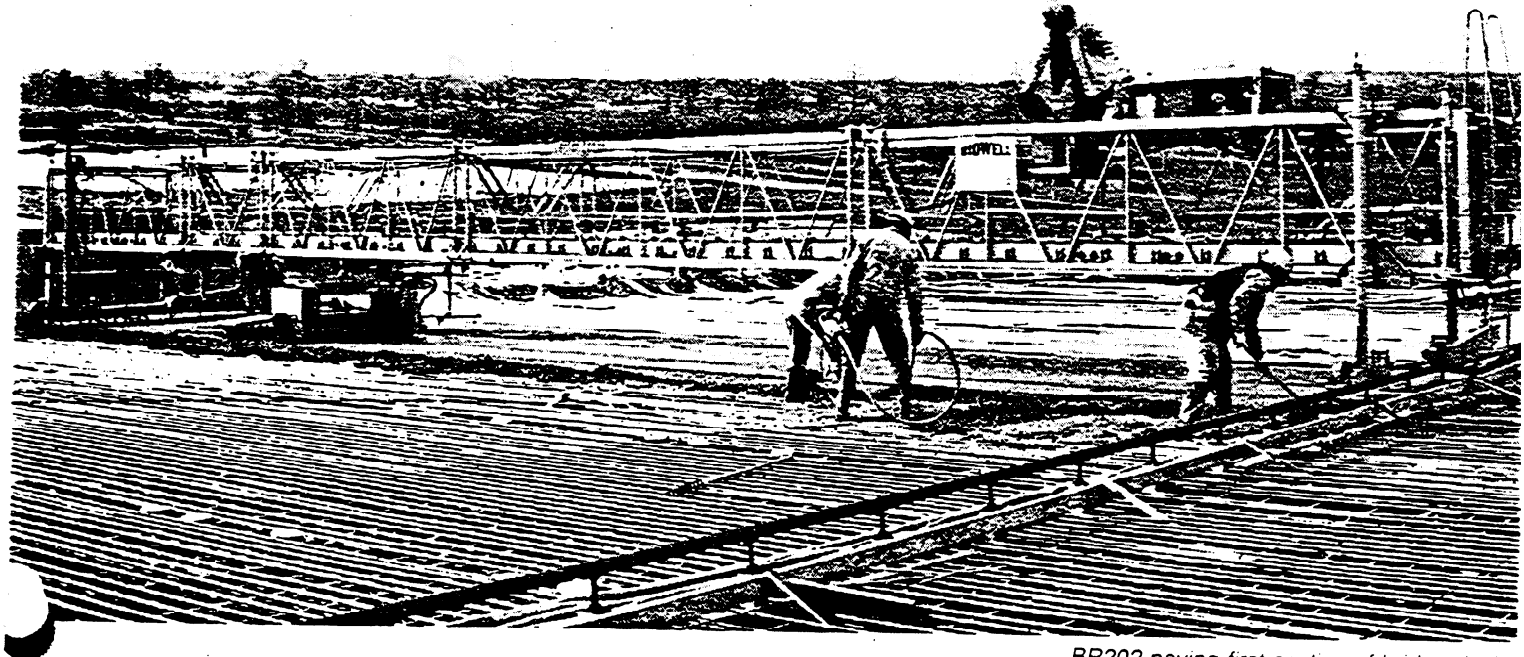
BR202 paving a slab for ship container storage



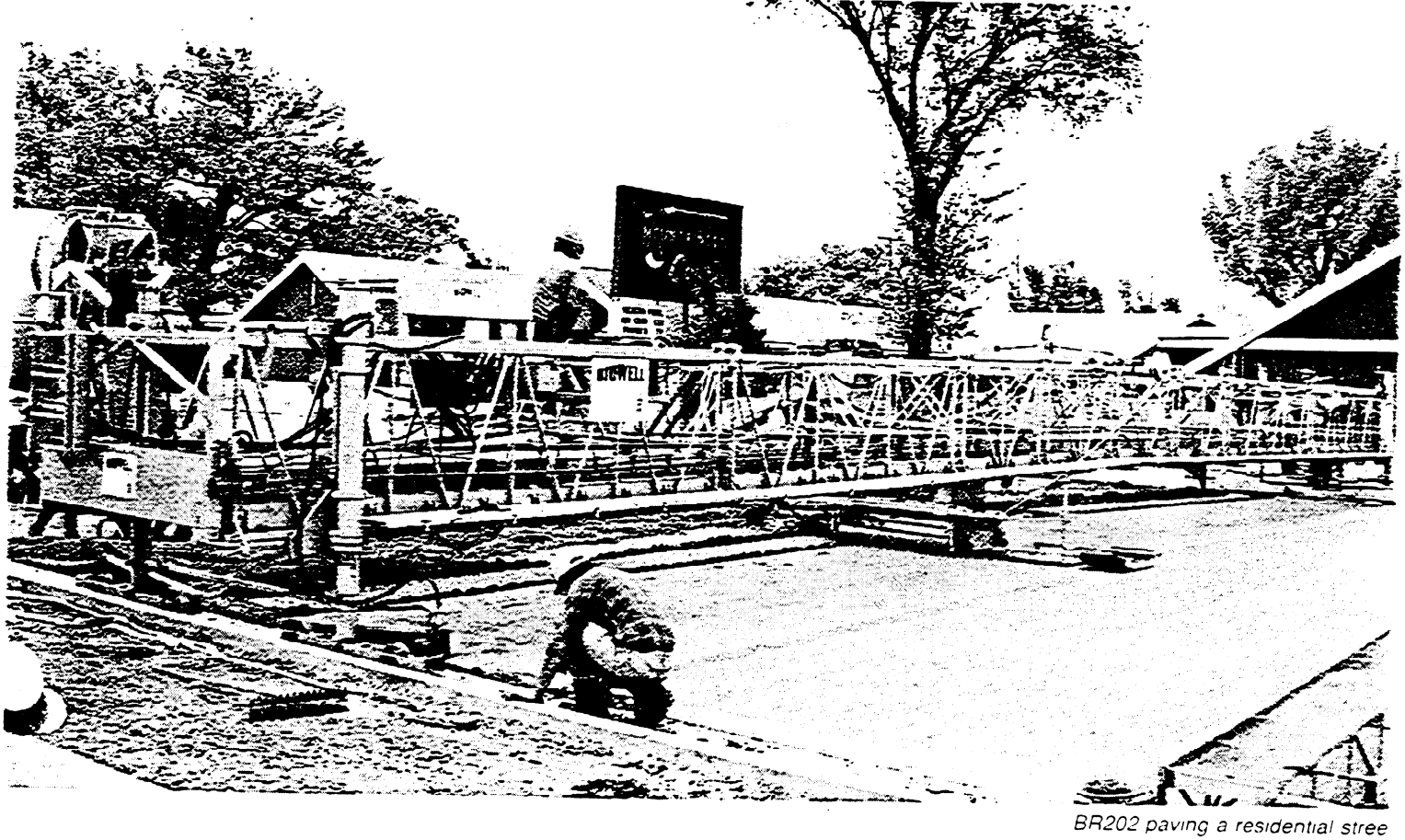
BR202 on skewed bridge



48202 paving bridge deck.

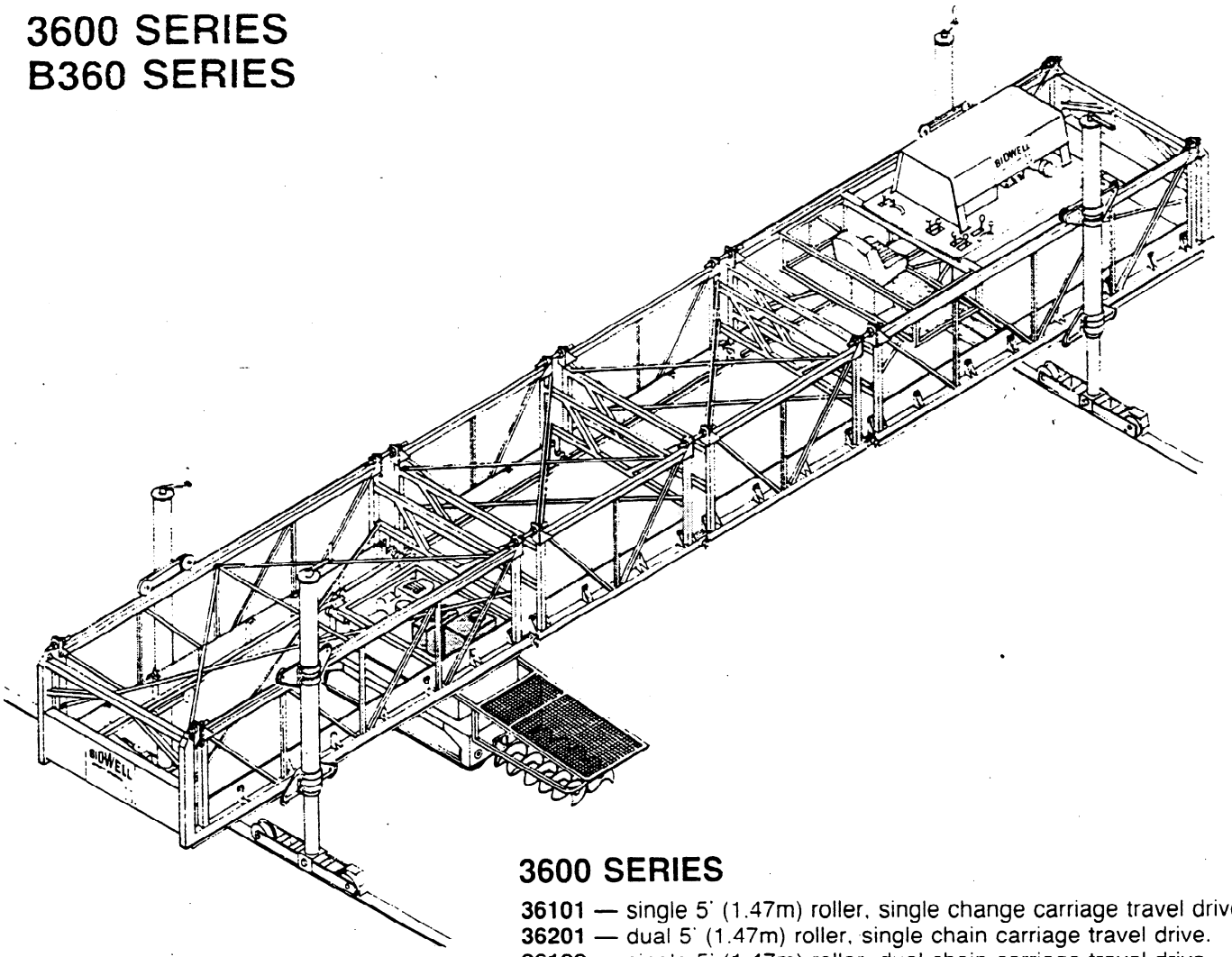


BR202 paving first section of bridge deck.



BR202 paving a residential stree

3600 SERIES
B360 SERIES



3600 SERIES

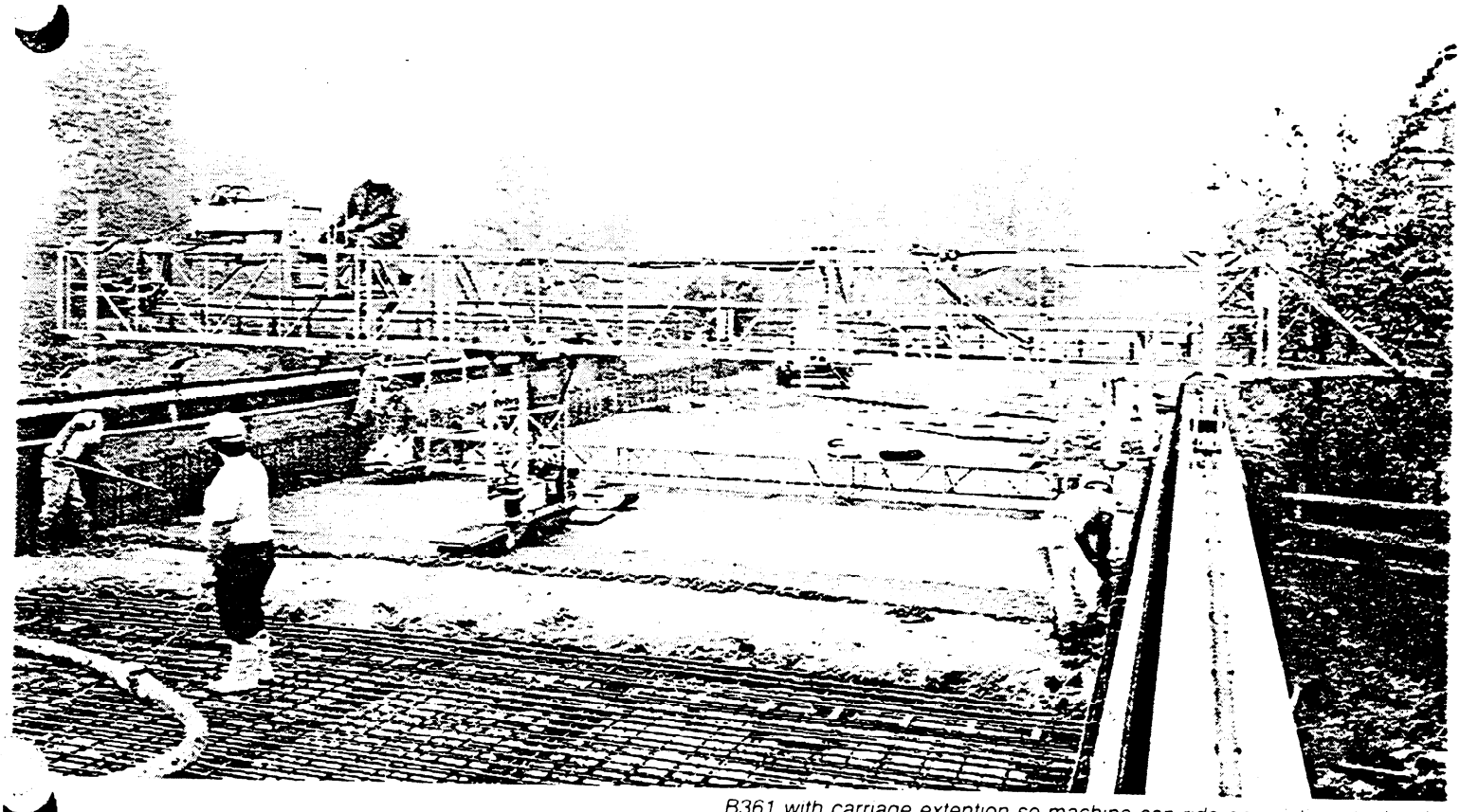
36101 — single 5' (1.47m) roller, single change carriage travel drive.
36201 — dual 5' (1.47m) roller, single chain carriage travel drive.
36102 — single 5' (1.47m) roller, dual chain carriage travel drive.
36202 — dual 5' (1.47m) roller, dual chain carriage travel drive.
36202HD — dual 5' (1.47m) rollers, dual chain carriage travel drive, 6" (0.15m) legs and 2-16HP (11.9KW) engines and heavy duty carriage travel motor.

B360 SERIES

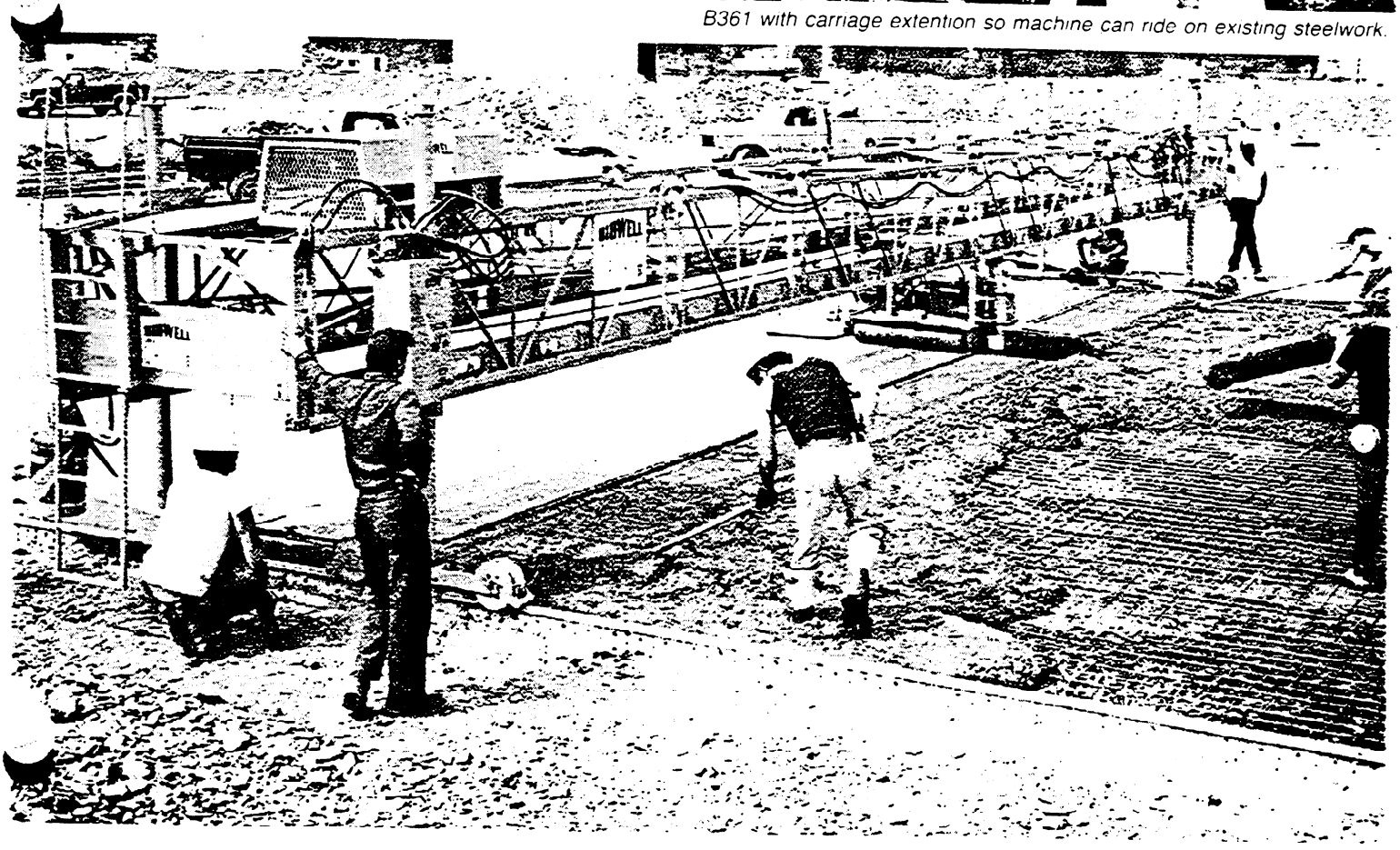
B361 — single 4' (1.22m) roller, single chain carriage travel drive.
B362 — dual 4' (1.22m) roller, single chain carriage travel drive.
2" — 14HP (10.4KW) Kohler air-cooled engines.

SPECIFICATIONS common to the above:

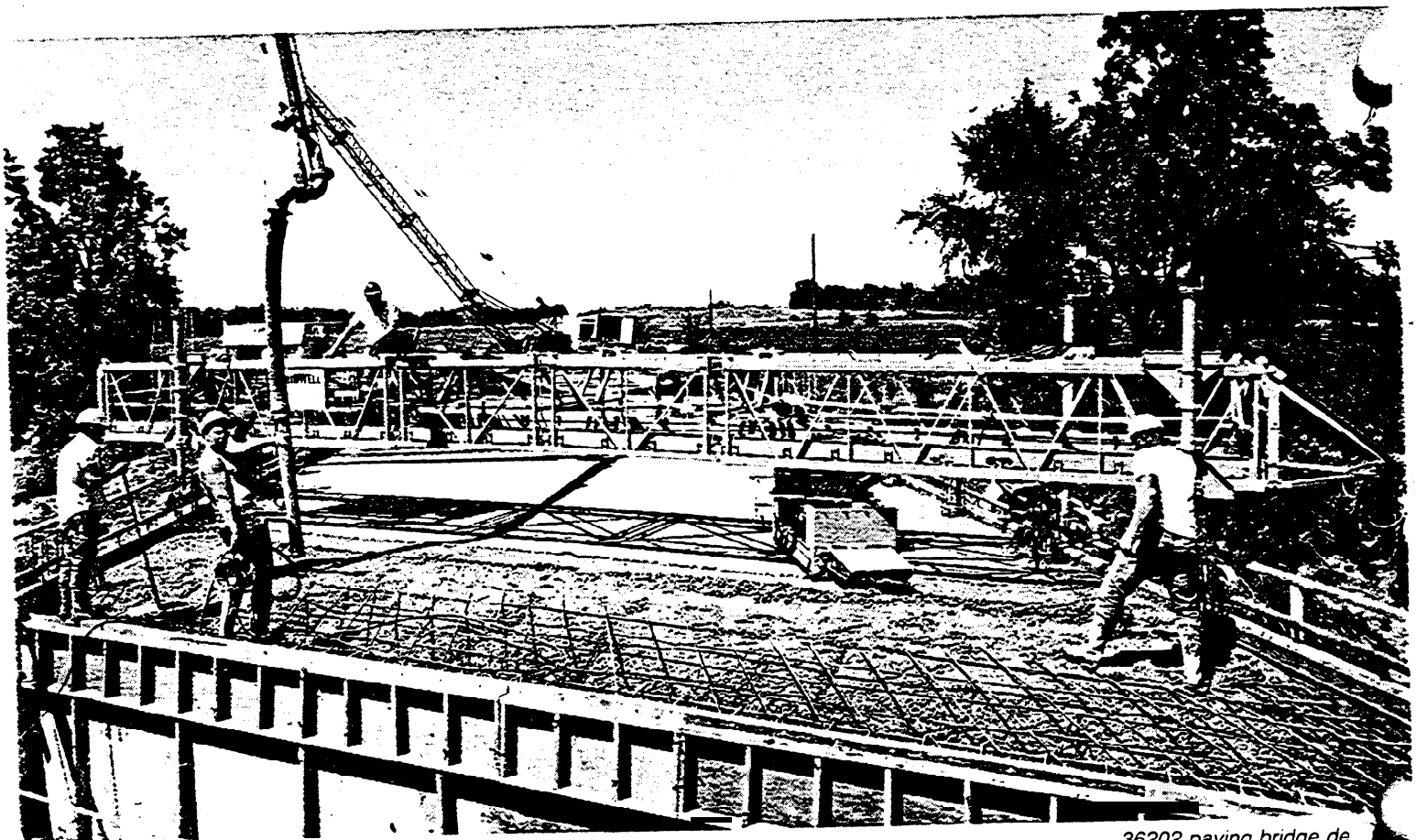
1. Basic 36'(11 .0m) unit made up of square end sections. 36"(0.91 m) deep truss.
2. With up to 15(4.6m) of leg travel on each 18'(5.5m) end section.
3. Crown may be changed at any hinge point or at any travel rail adjuster.
4. By adding 3'(0.9m). 6'(1.8m). 12'(3.7m). 15'(4.6m) or 18'(5.5m) inserts the basic machine can finish 100'(30.4m) wide. No extra overhead truss required.
5. 3600 powered by two 16HP (11.9KW) Kohler air-cooled engines. 8360 series powered by two 14HP (10.4KW) Kohler air-cooled engines. Other options available.
6. Dual **24"** (0.61m) quick crank augers with double flighting.
7. Independent roller rotation valve kit with automatic skew cylinder on 3600 series.
8. Variable speed carriage travel up to 80' (24.4m) per minute.
9. Independent hydraulic direct drive motor on each roller.
10. Manual override to stop and reverse carriage at any point.
11. Eight bogied carriage rollers with hold down rollers to prevent floating on 3600. Four single carriage rollers on 360.
12. Four machine travel bogies with wheels at 36" (0.91 m) centers on each bogie on legs 67" (1.70m) apart. Making the total span of the wheels 103" (2.6m) out to out.
13. Crank adjustable finishing pan with astro grass or burlap drag.
14. Flat flanged wheels or concave wheels.
15. 4" (0.10m) heavy duty legs.



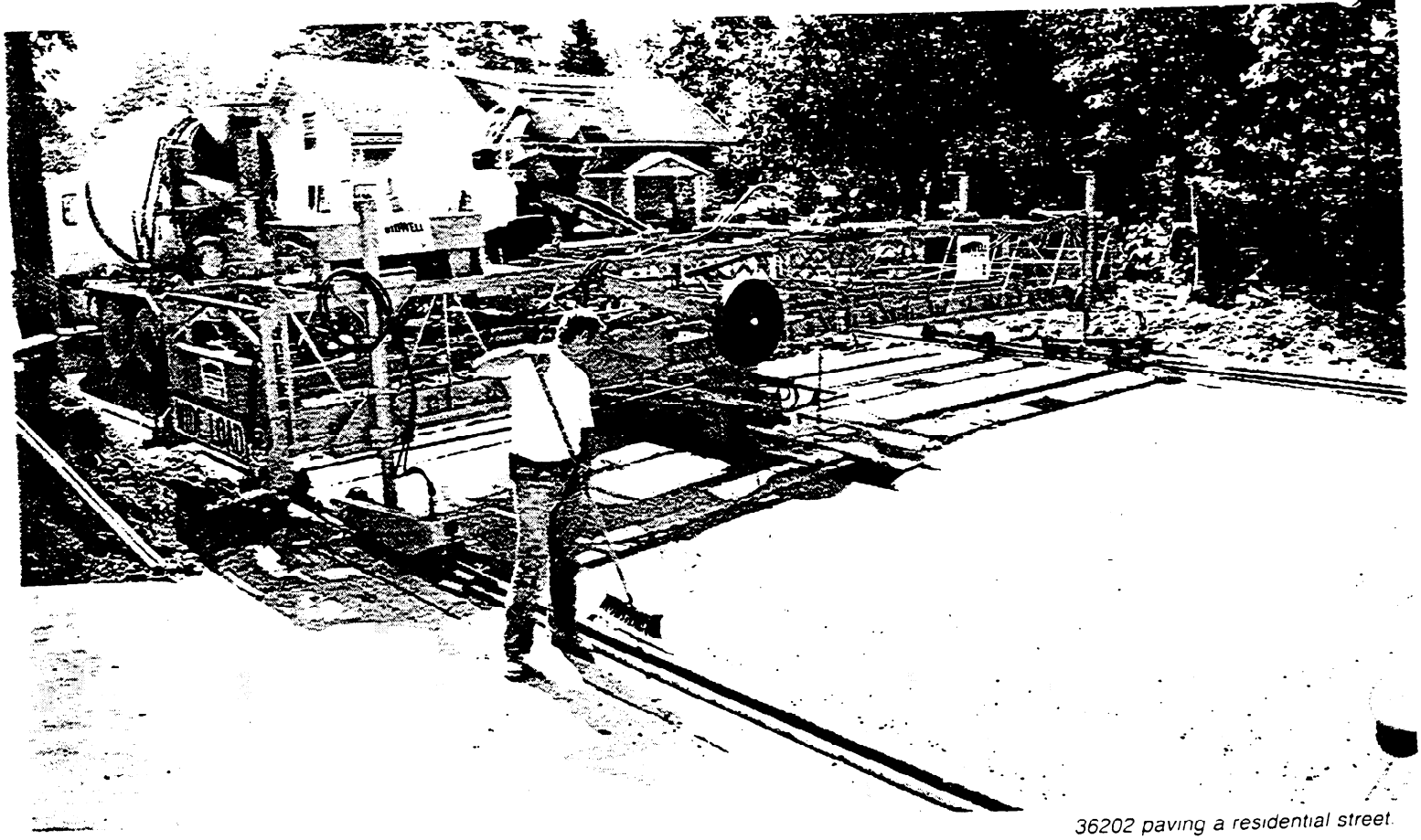
B361 with carriage extention so machine can ride on existing steelwork.



B362 paving.

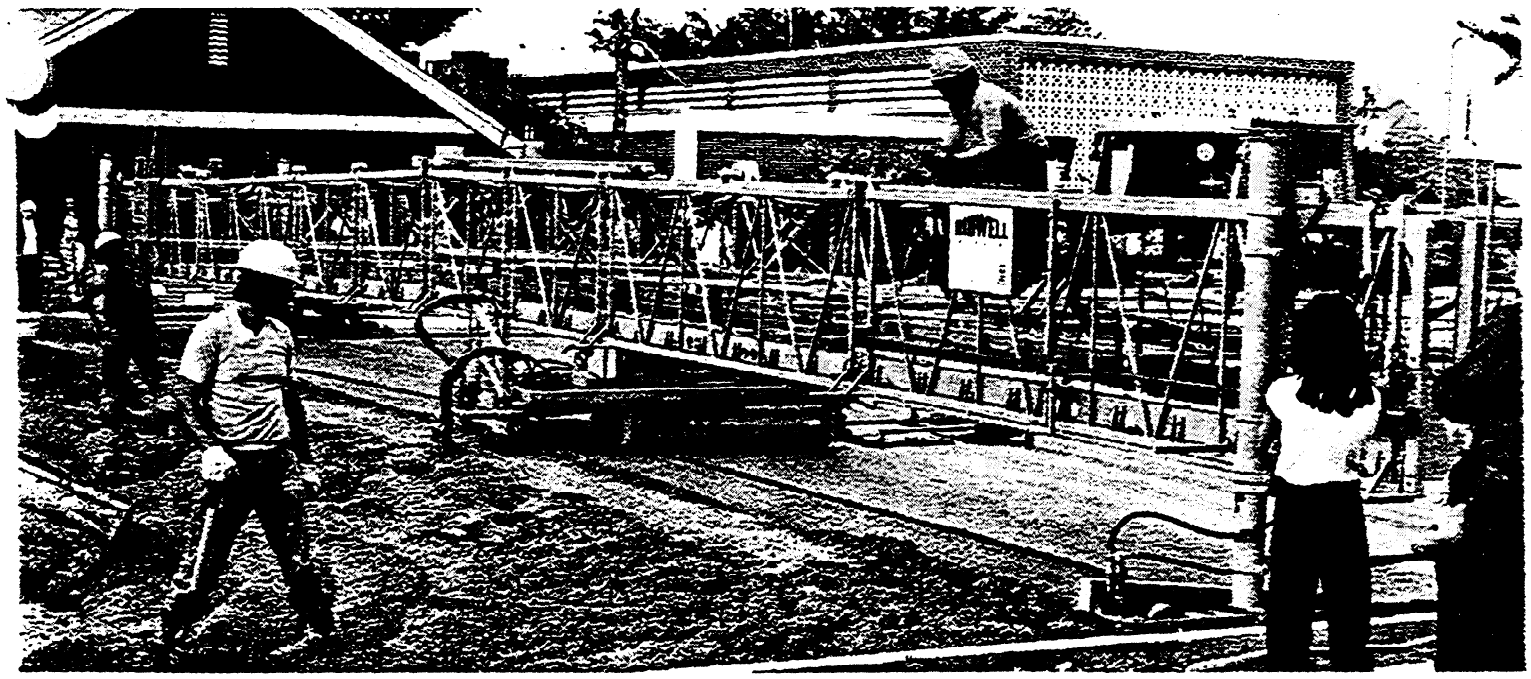


36202 paving bridge de

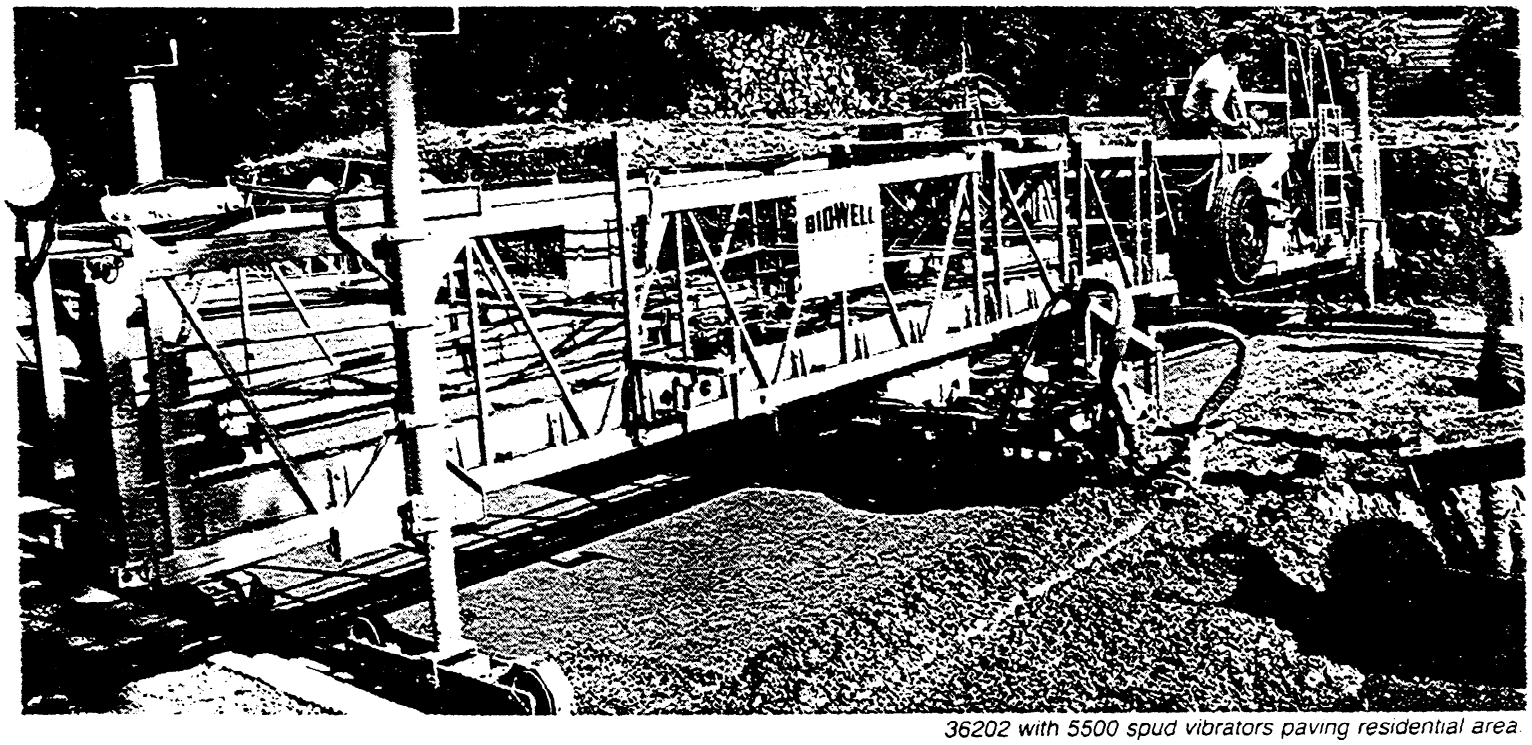


36202 paving a residential street

OPTIONS AVAILABLE



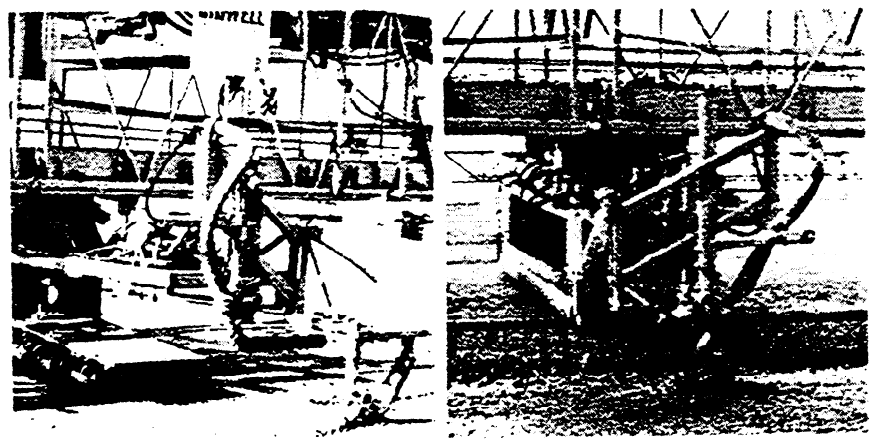
48202 with 5500 spud vibrators paving a city street.

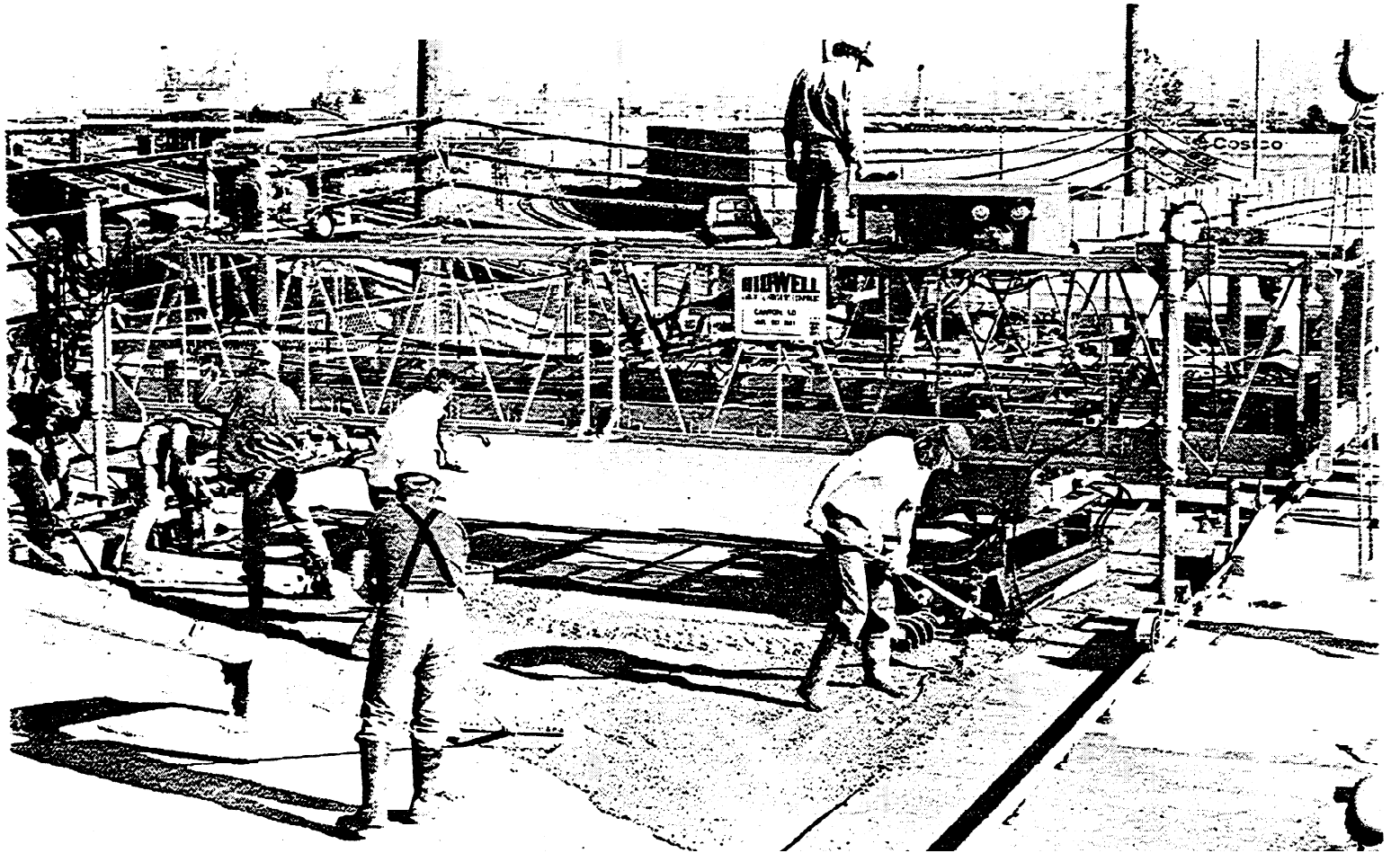


36202 with 5500 spud vibrators paving residential area.

5500 spud vibrators to vibrate concrete on slabs

Another Bid-Well original are twin spud vibrators ahead of the leveling augers. Each vibrator alternately lowers into the concrete as the other vibrator is raised, It follows and consolidates. operating automatically in the direction of carriage travel.





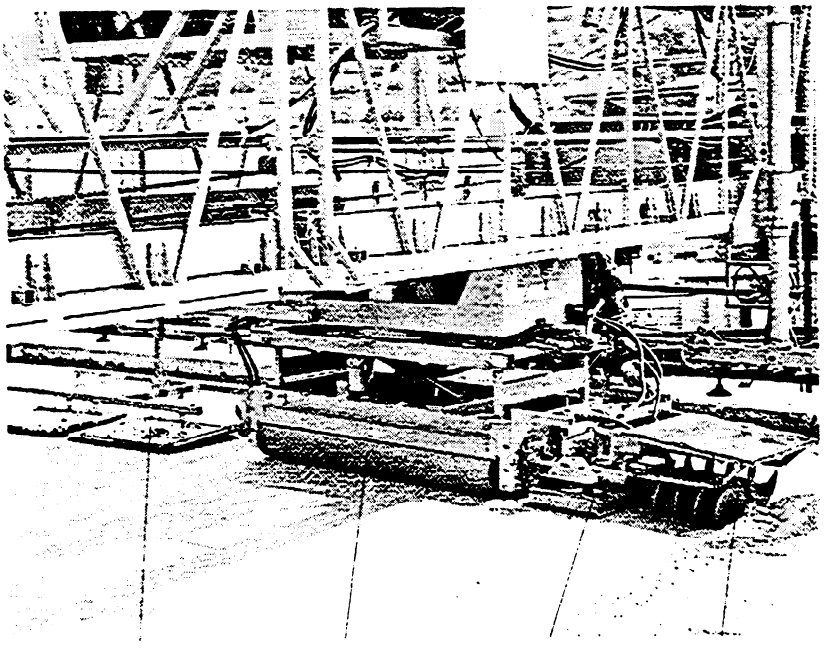
LATEX OVERLAYS

Bid-Well spreads, vibrates and finishes in one operation

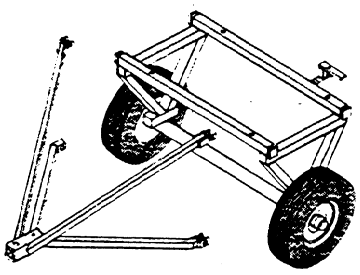
The addition of a hydraulically driven. rubber mounted. fully adjustable pan-type vibrator to a standard Bid-Well roller finisher makes it ideal for finishing latex overlay. In fact. the Bid-Well method of vibrating the surface. after the augers have trimmed the concrete to grade. has achieved the best results of any method on the market.

The dual augers move concrete forward on every pass. Mounted in front. they remove excess concrete so the overlay vibrator can achieve ideal consolidation.

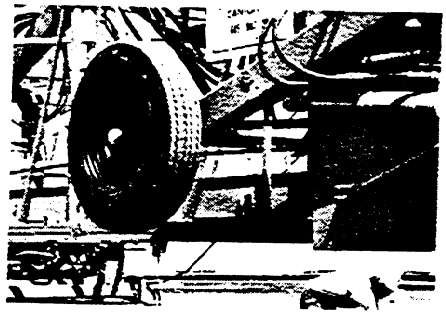
The vibrator has a variable speed to fit the consolidation needs of various slumps. It has a rapid screw-type height adjustment to achieve an exact vibrator surface pressure.



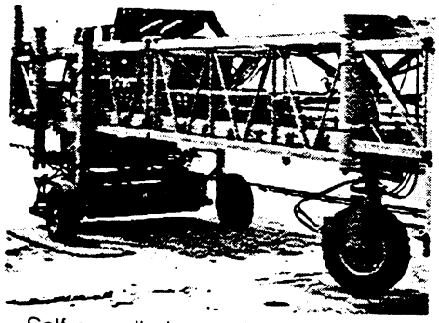
OPTIONS AVAILABLE



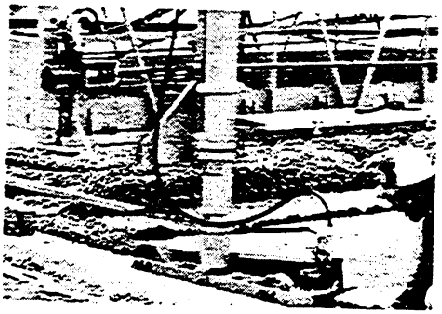
Towing tongue and transport dolly.



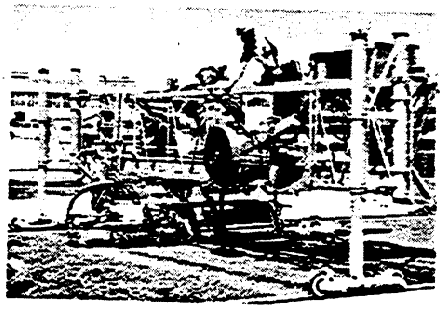
Power fold dolly.



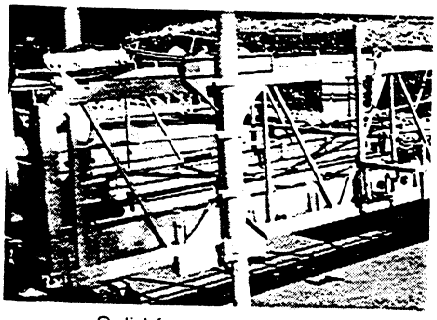
Self-propelled steerable nose wheel. Can be folded.



Powered leg widening.



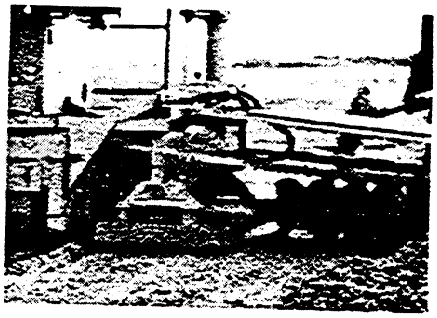
Swing-out legs for special applications.



Solid frame leg holder.

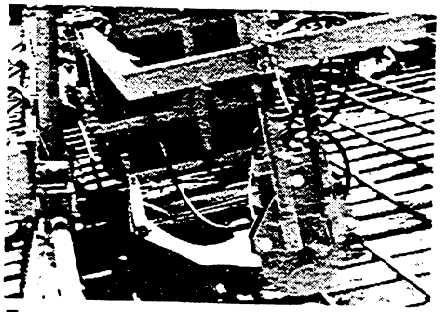
Automatic roller skewing device on carriage.

Powered crown adjuster.

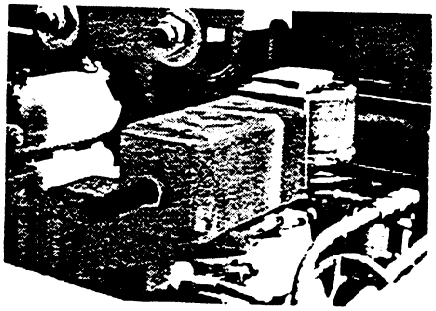


Pan vibrator.

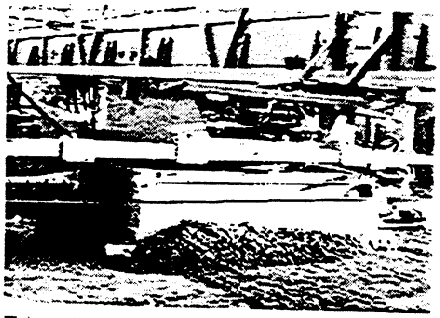
Retractable carriage. Shown raised and lowered.



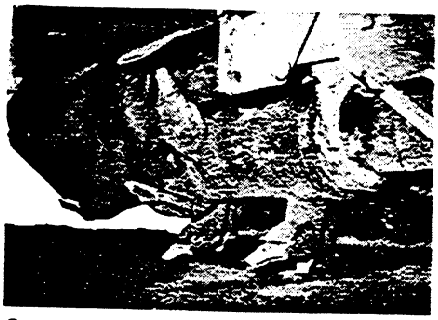
Transverse groove cutter--vibrating disk.



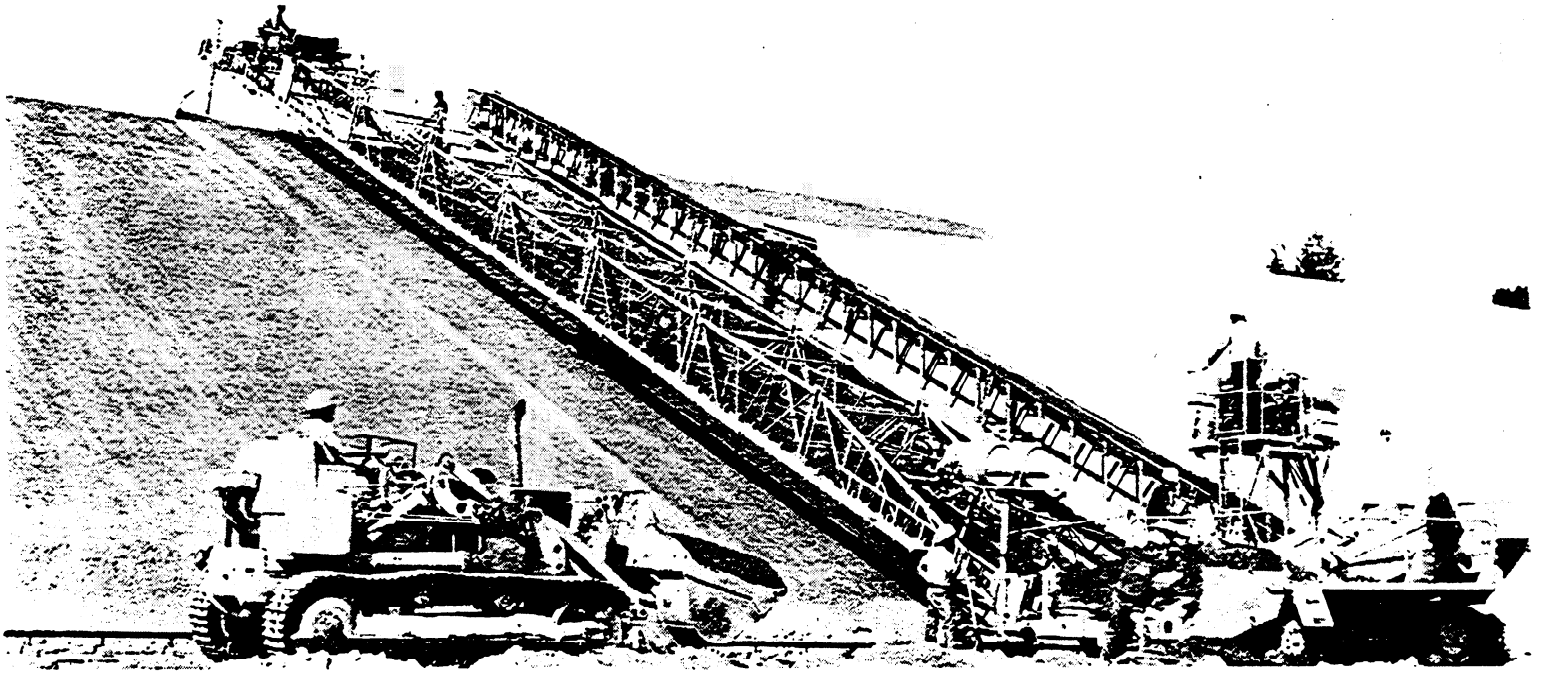
Side thrust rollers maintain carriage stability. Exclusive with Bid-Well. Standard on HD machine.

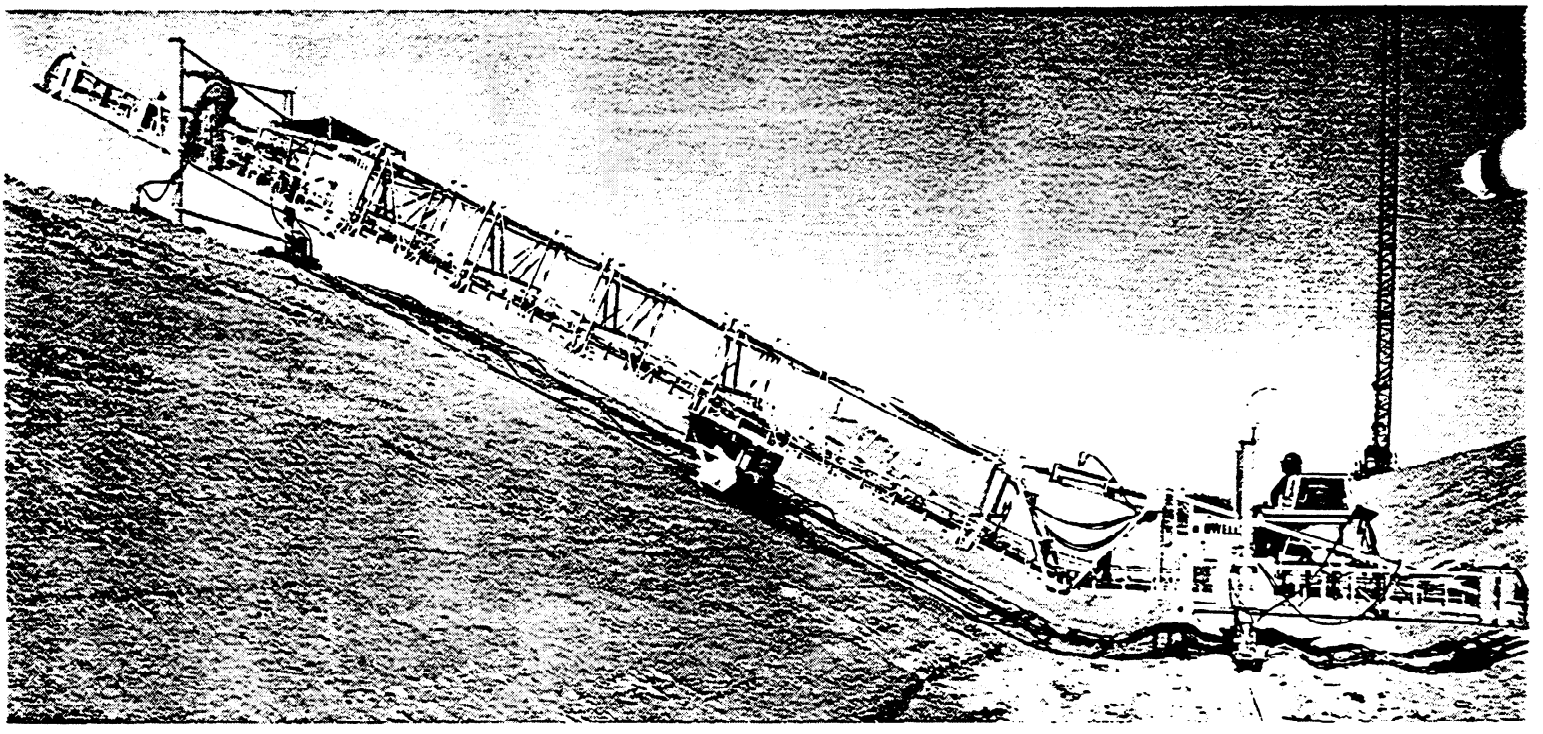


Trimming blade permits fine grading of the sub-base with finishing carriage.



Complete trimming carriage available with powered rotary head.





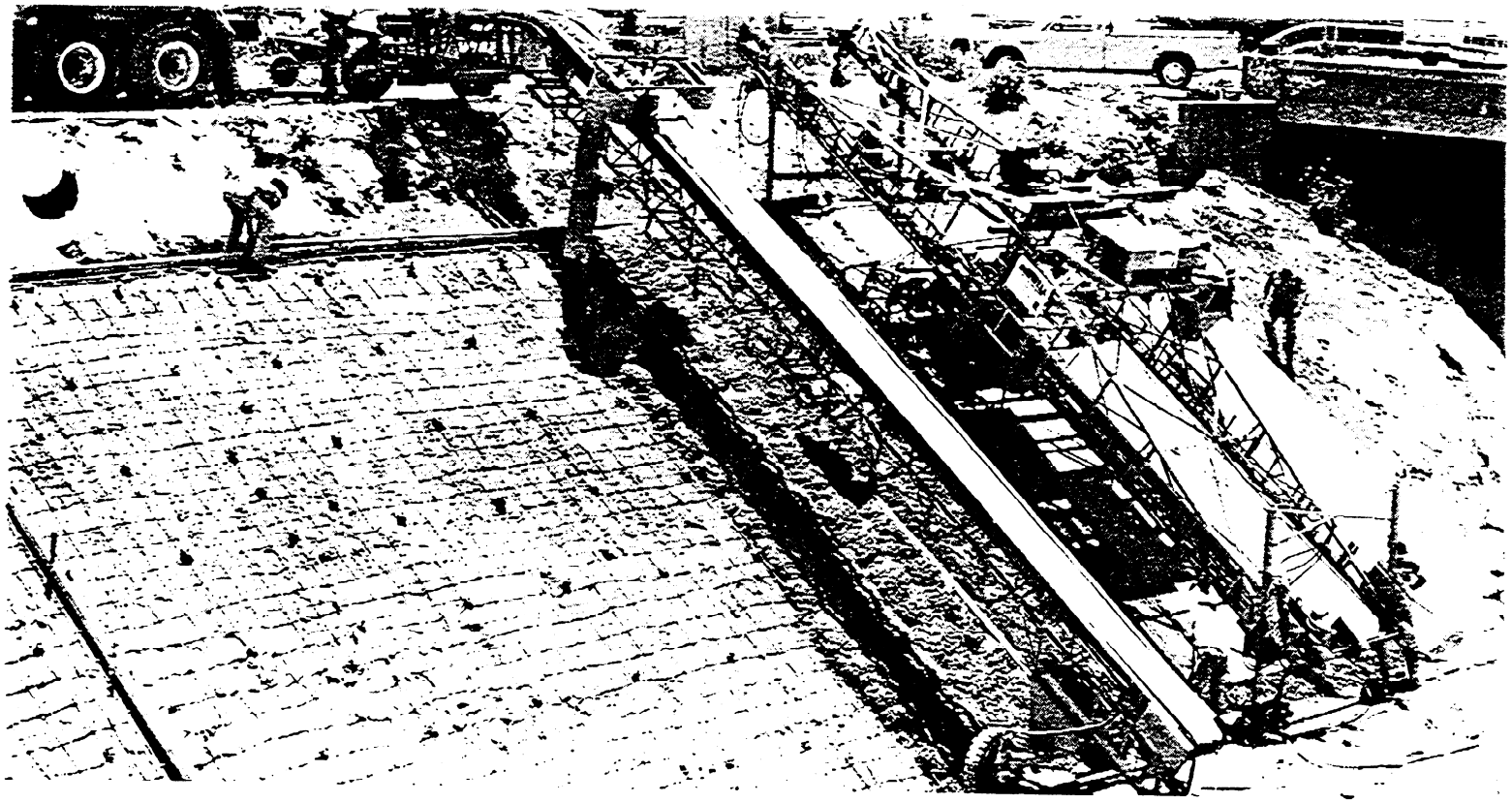
SLOPES as steep as 1½:1

Fine grades the sub-base and then finishes concrete on slopes!

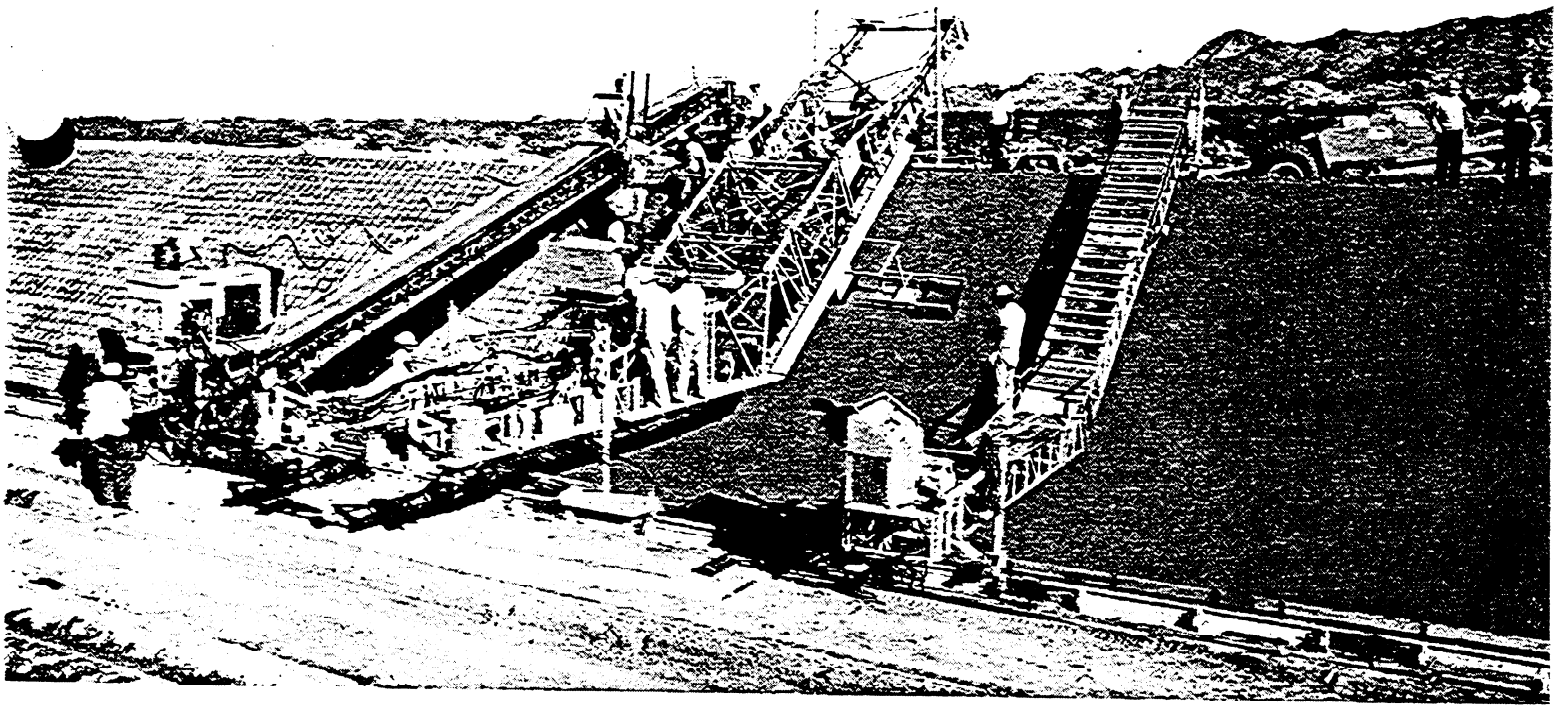
The slope paver has special adjustable slope leg brackets that keep legs vertical while the machine is on any slope The mounting for the power control console and the power unit on the carriage also can be tilted to remain even in operation. These mountings can be ordered on a new Bid-Well or can be added to any existing Bid-Well.

Slope trimming is done with a detachable blade on the roller carriage that trims only while going down the slope. Trimming the sub-base gives a more accurate concrete yield.

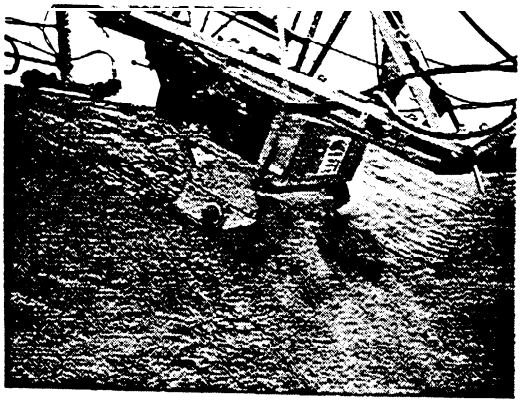
Then with the blade removed the roller finishes concrete going up the slope.



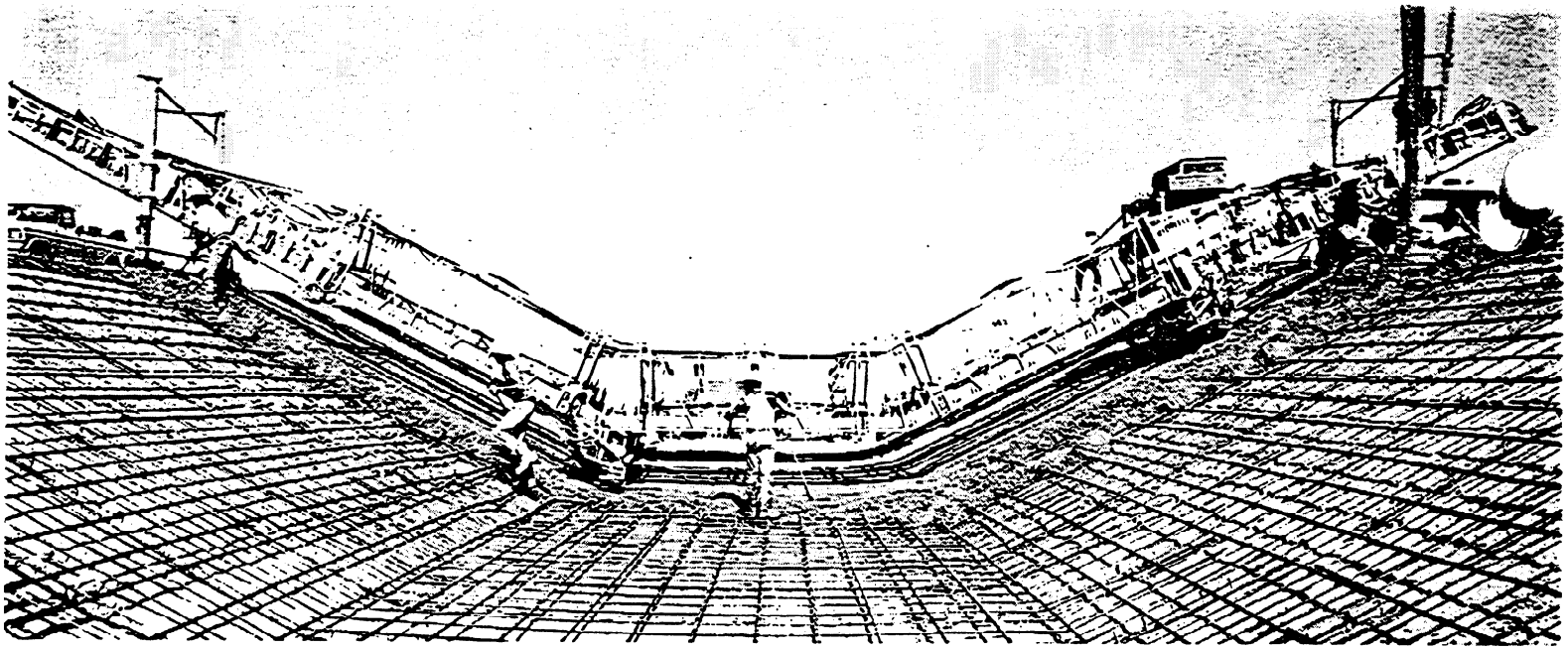
BR202 canal paver.



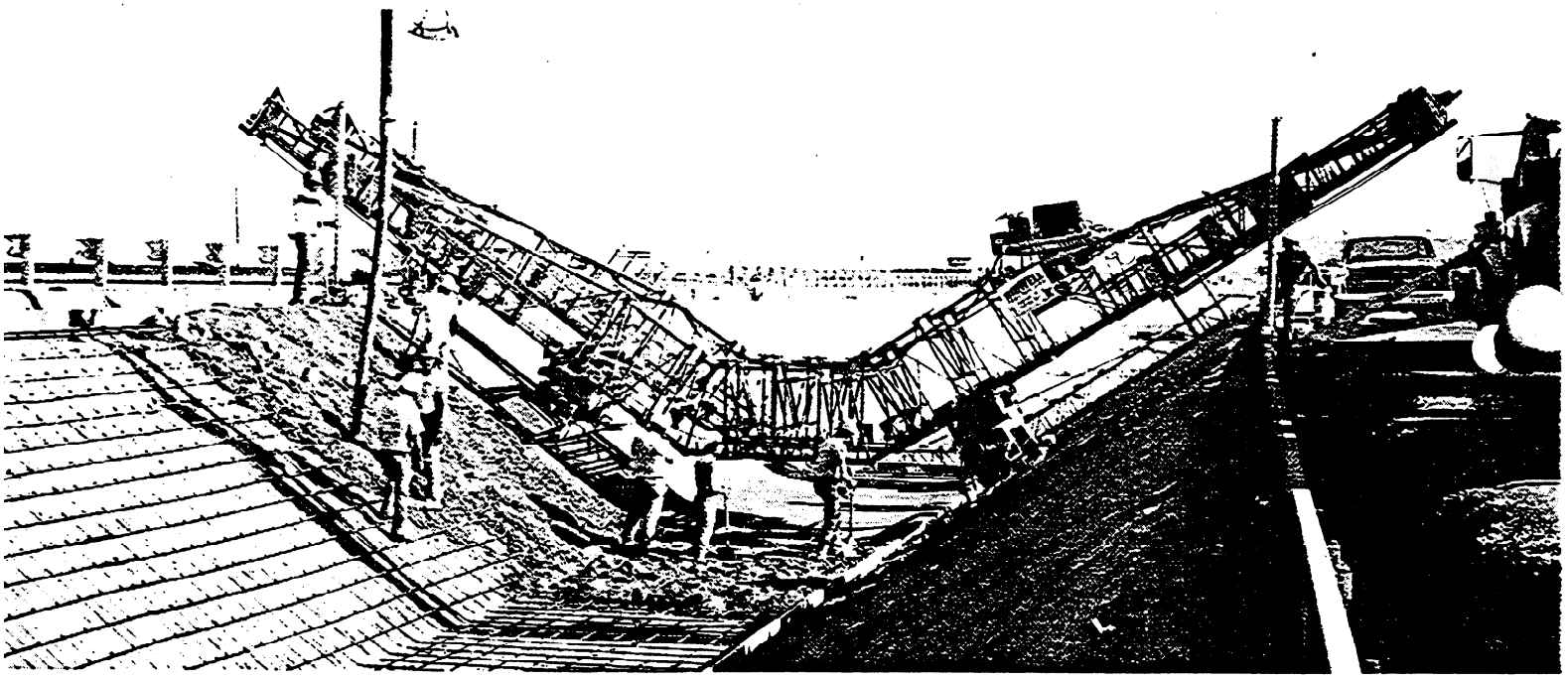
BR202 canal paver and powered workbridge.



(Left) Complete trimming carriage with powered rotary head.



BR202HD canal paver with one finishing roller per carriage



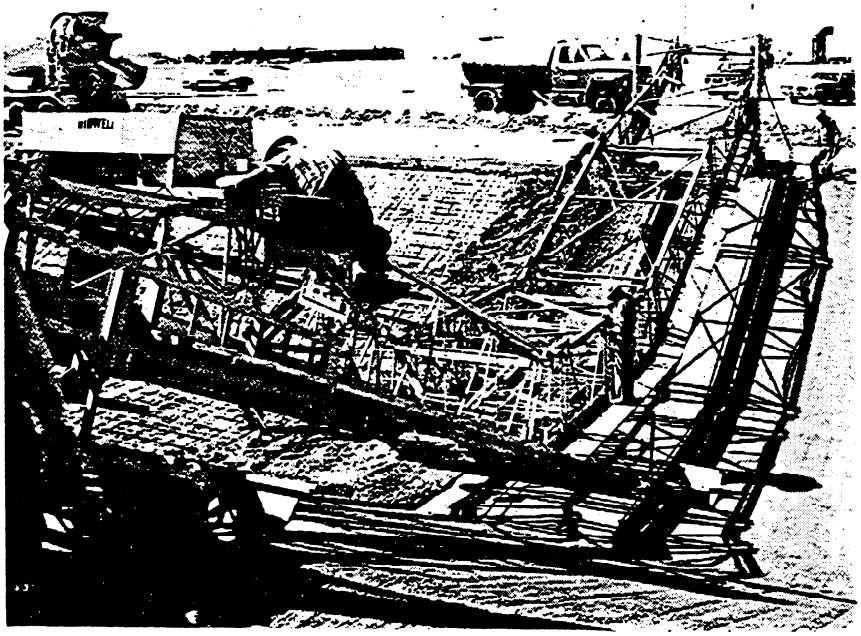
BR202HD canal paver with one finishing roller per carriage.

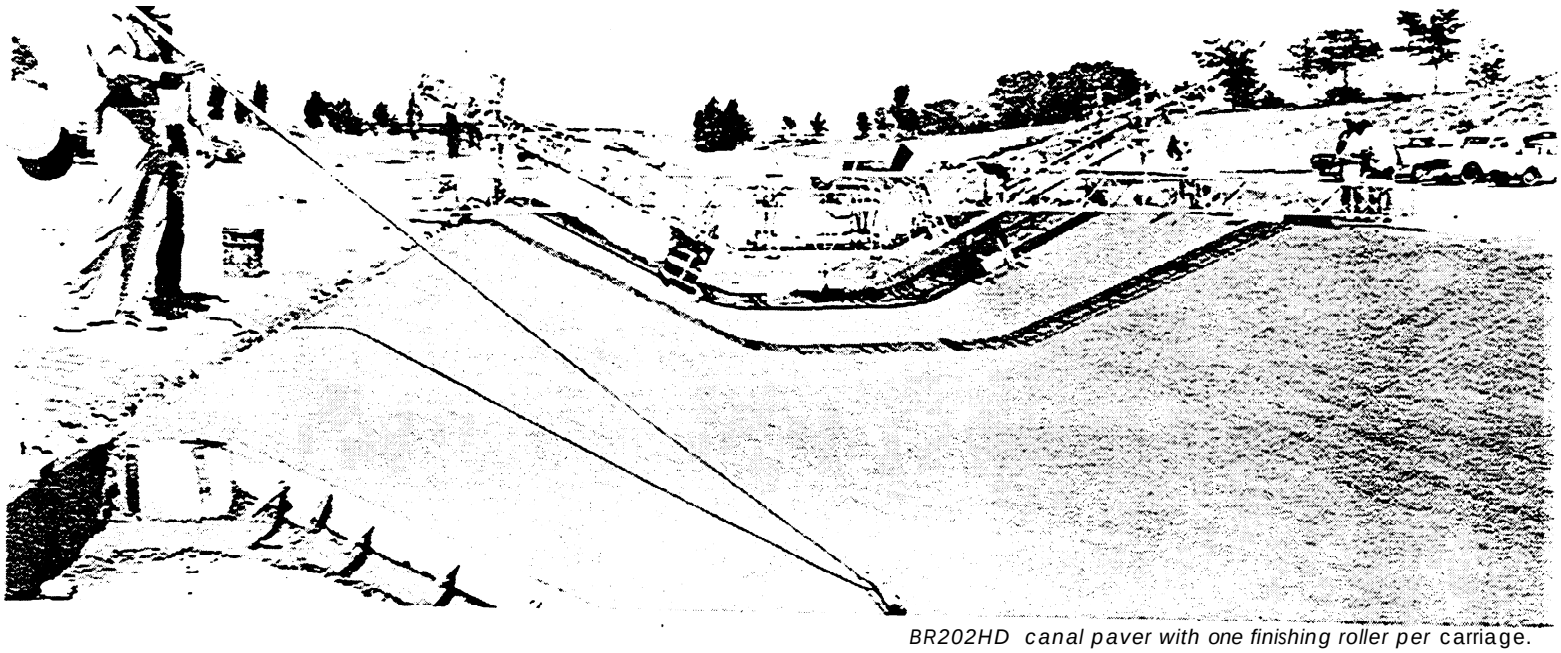
BR Series

FULL WIDTH
CANAL PAVERS

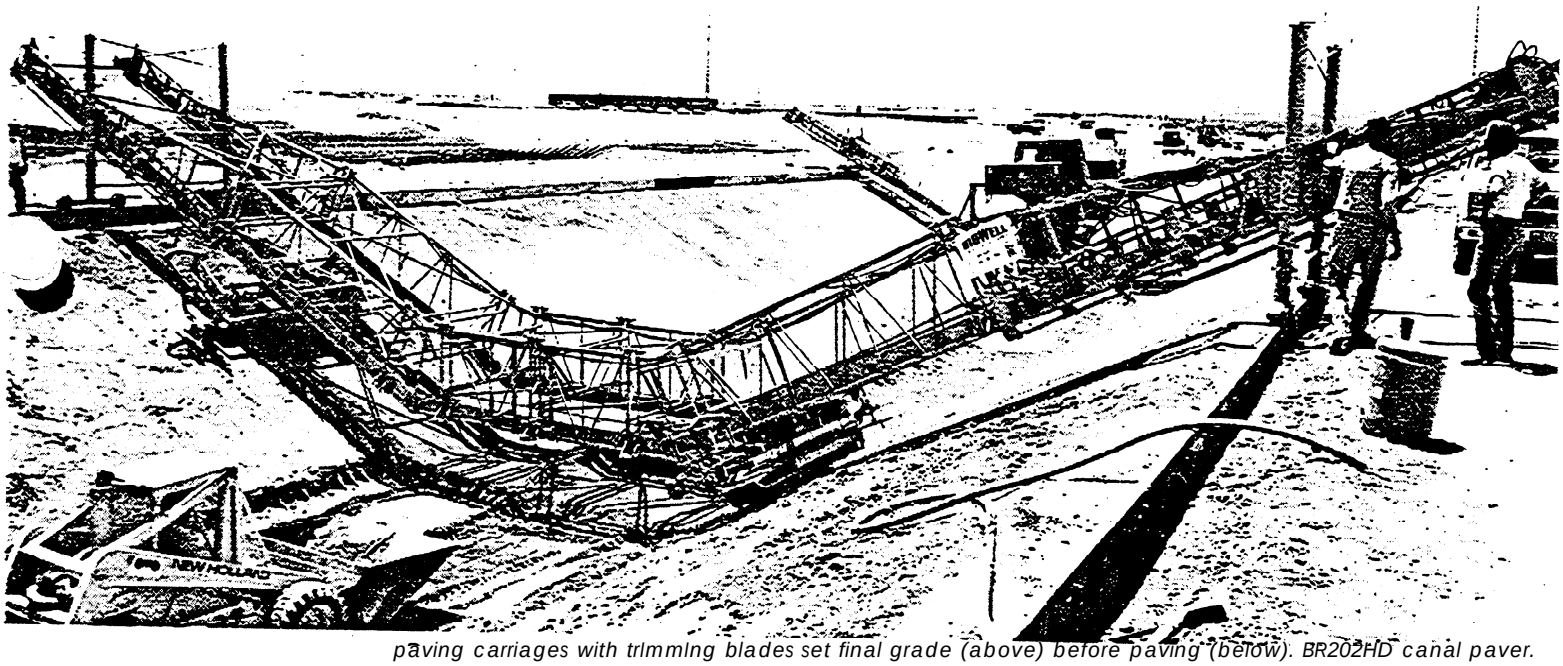
Bid-Well roller finishers can be adapted to pave the full width with single or double carriages. They often finish the invert and shoulders with the same pass. With the addition of blades. the same machine can trim the sub-grade as well.

Double carnages whose paths overlap slightly at the center permit paving both slopes and the invert at one time

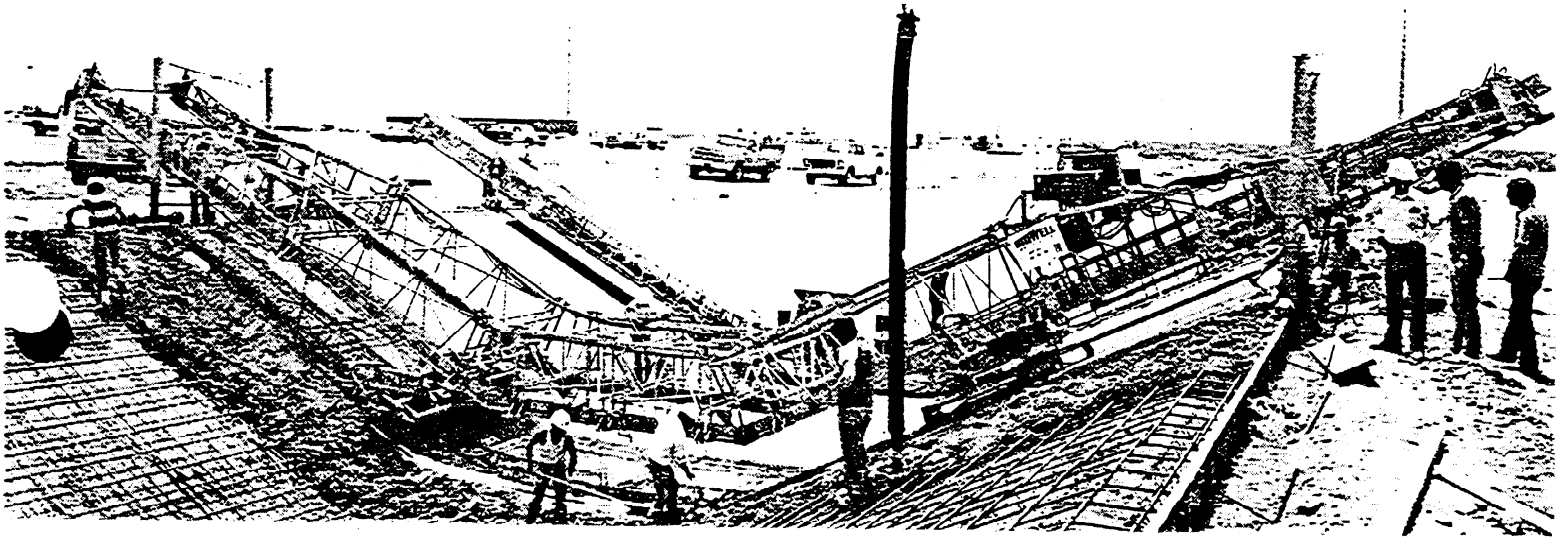


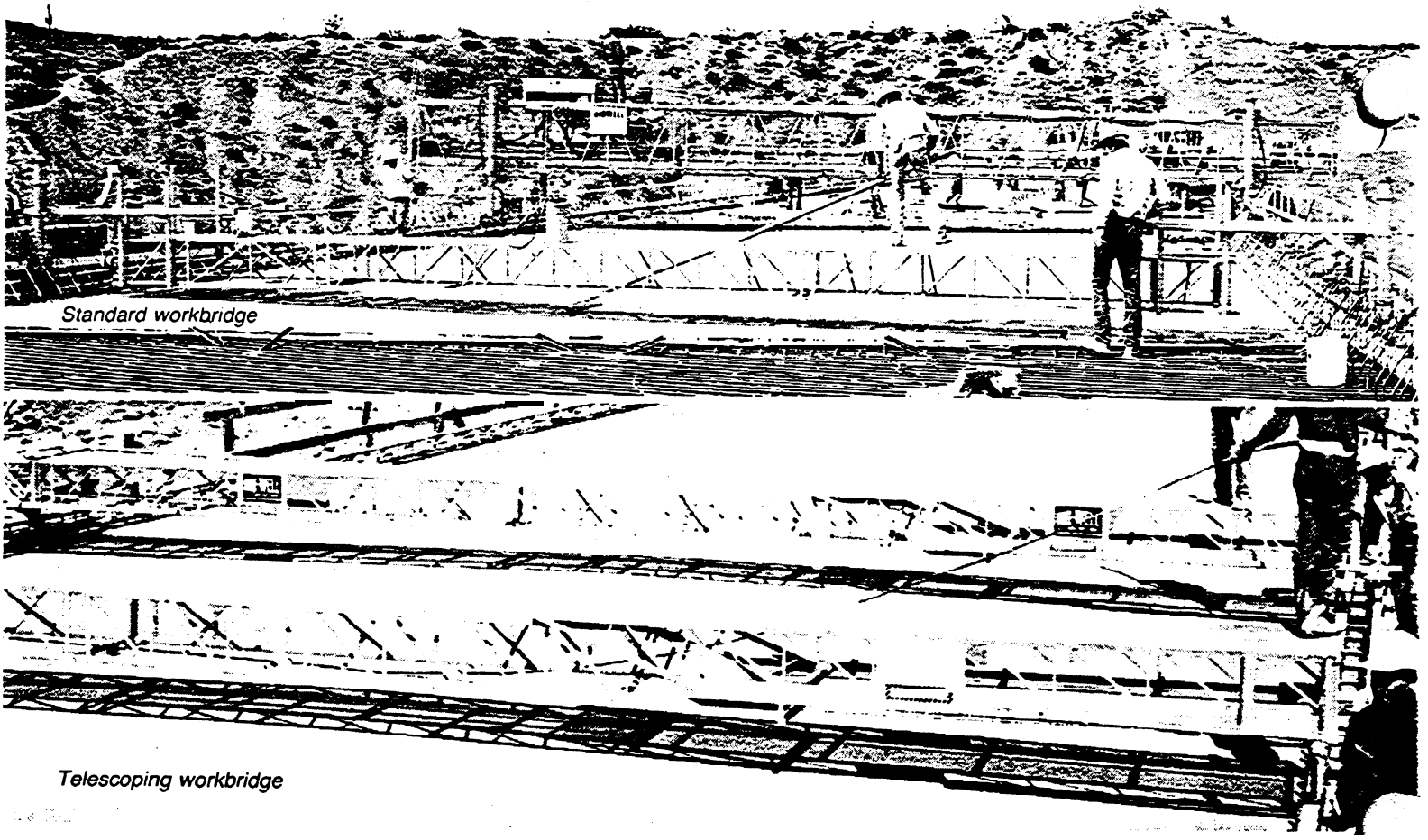


BR202HD canal paver with one finishing roller per carriage.



paving carriages with trlmmlng blades set final grade (above) before paving (below). BR202HD canal paver.





Standard workbridge

Telescoping workbridge

BID-WELL WORKBRIDGES

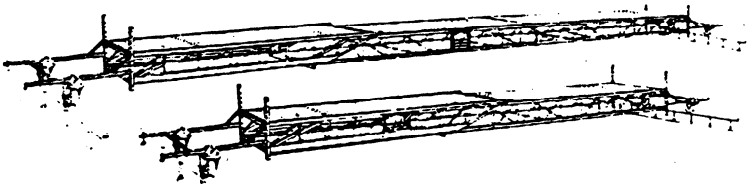
COMMON FEATURES:

STANDARD 'OR TELESCOPING

- Rugged lightweight tubular steel trusses, 34" (0.86m) wide. 18" (0.46m) or 24" (0.61 m) deep. 16-gauge expanded metal non-slip decking.
- Weight: approximately 190 Lbs. (86.2 KG) per ten feet of length.
- Quick assembling and dismantling. No bolting required for any length. Breaks down into sections to haul easily.
- Standard lengths available up to 105' (32.0m) on 18" (0.46m) deep boom or 140' (42.7m) on 24" (0.61 m) deep boom.
- Four 6" (0.15m) flat flange or concave wheels standard. Other wheels available.

STANDARD NON-TELESCOPING ENDS

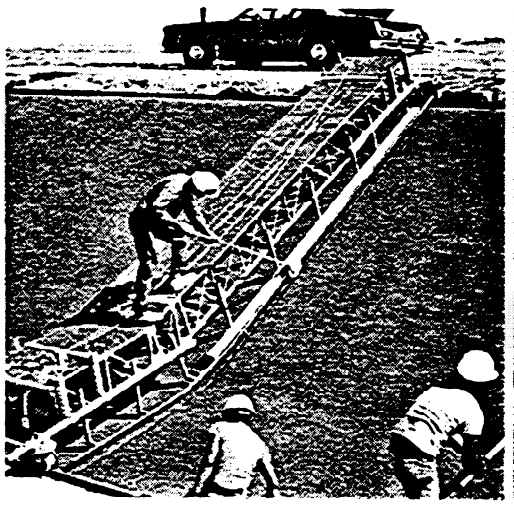
Each end section has a 4' (1.22m) width adjustment for a total of up to 8' (2.44m) of wheel width adjustment.

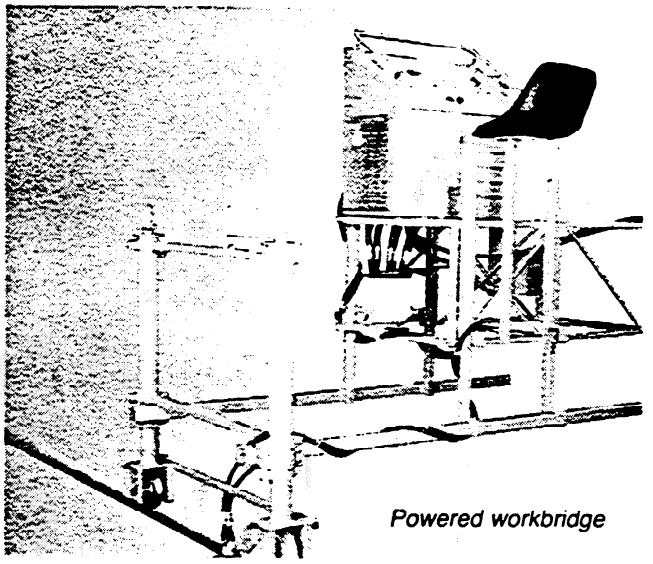


TELESCOPING END SECTIONS

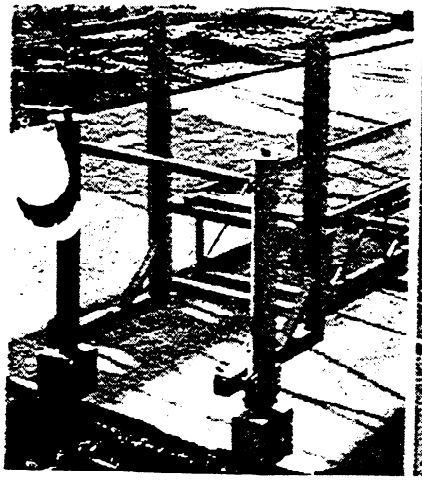
Each telescoping end section telescopes 10' (3.1 m). (Example: A 15' (4.6m) workbridge telescoping end section can expand to 25' (7.6m). A workbridge with two telescoping ends can expand 20'(6.2m).

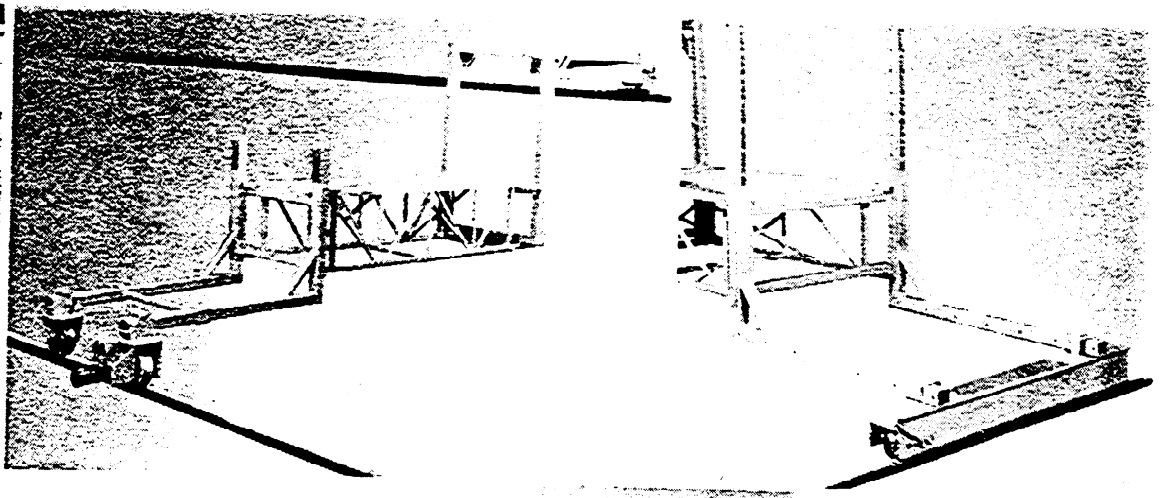
(Right) Workbridge with guide to cut grooves in fresh concrete.

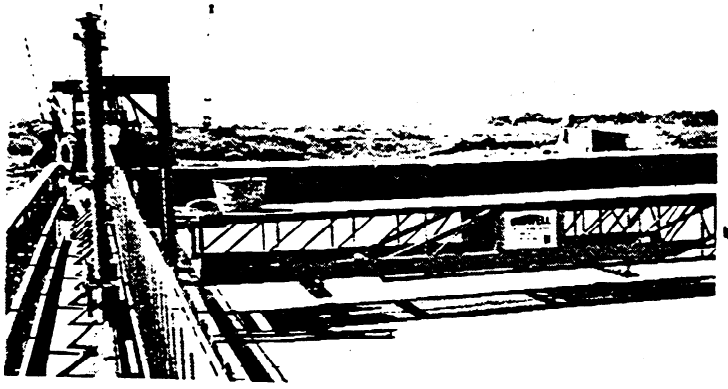


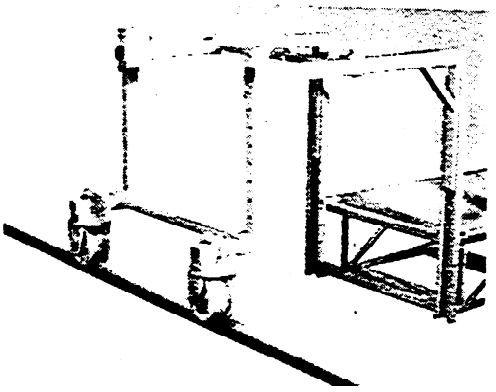


Powered workbridge

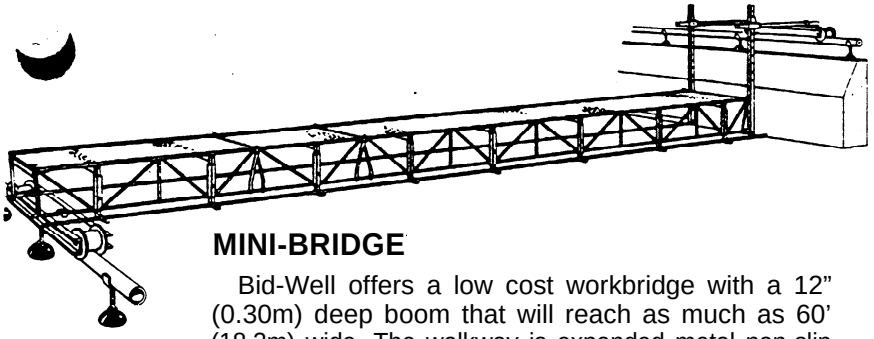






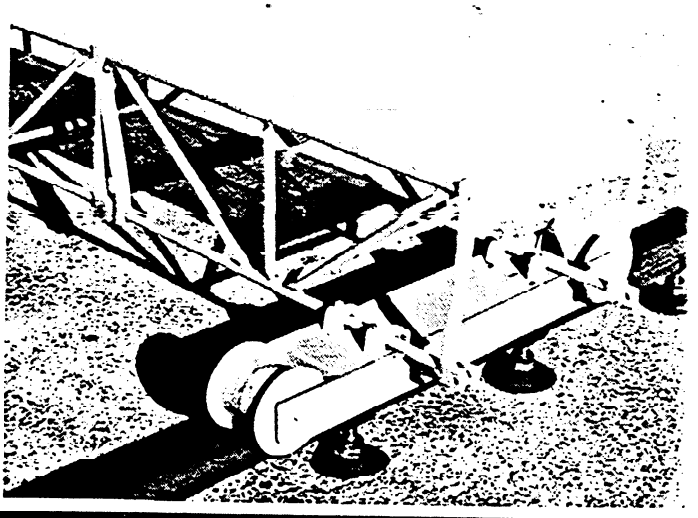


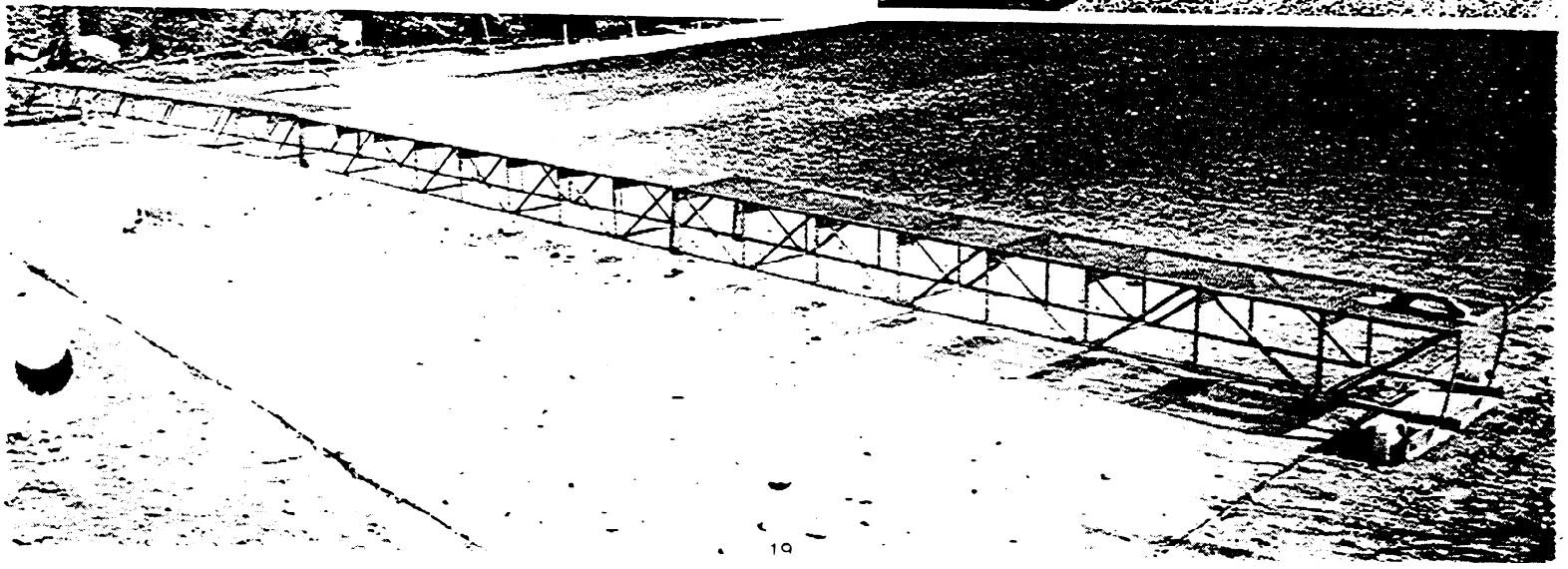
Bid-Well workbridge leg mounts options are available to fit any application.

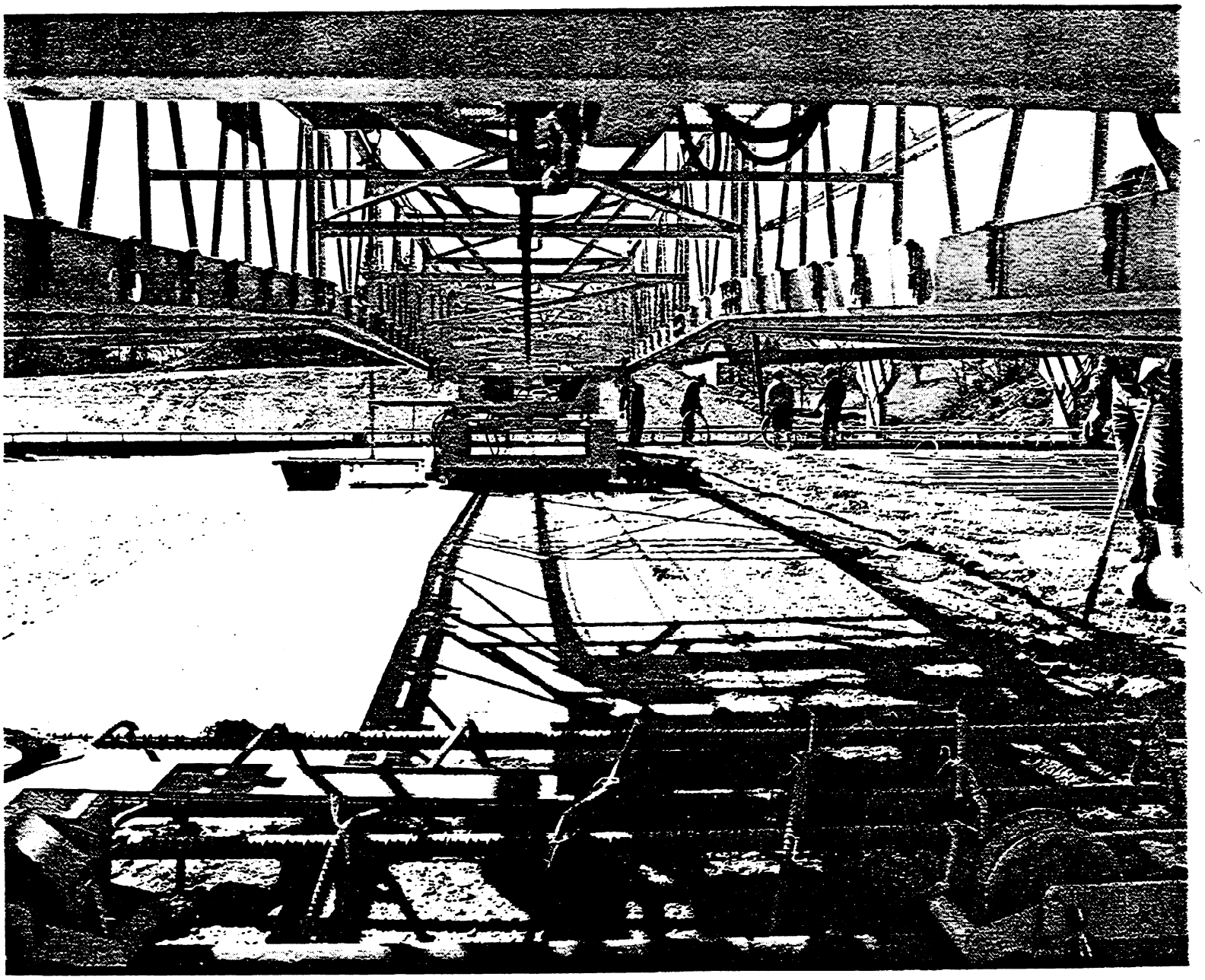


MINI-BRIDGE

Bid-Well offers a low cost workbridge with a 12" (0.30m) deep boom that will reach as much as 60' (18.3m) wide. The walkway is expanded metal non-slip decking 18" (0.46m) wide. Sections are available in 3' (0.9m), 6' (1.8m) and 12' (3.7m) lengths. Tower assembly allows workbridge to ride wall-mounted rail or median barrier up to 41" (1.04m).







Look to the Leader

cmi BID-WELL

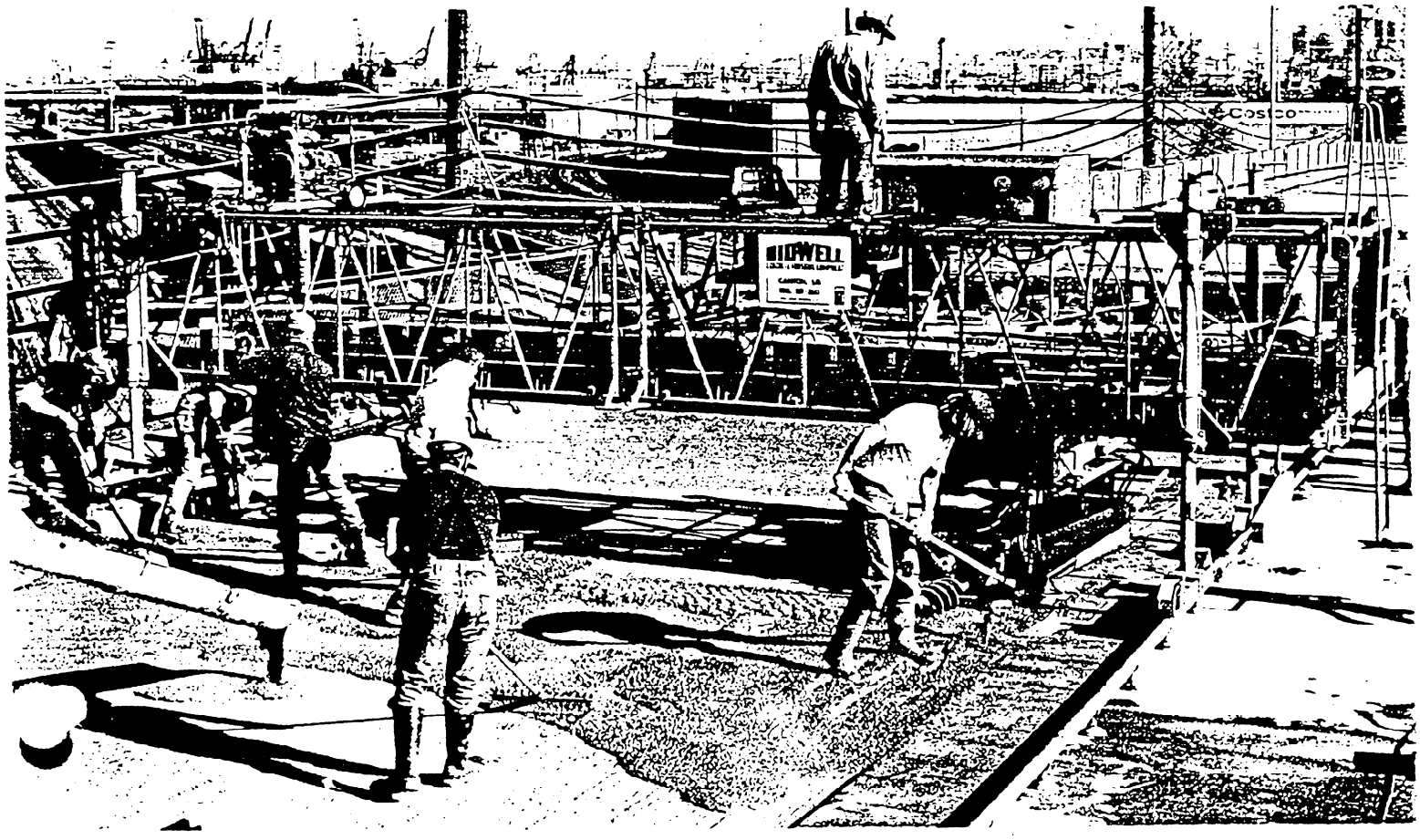
A DIVISION OF CMI CORPORATION
Box 97 CANTON, SD 57013
Telephone (605) 987-2603 Telex: (CMI International) 747167

Bulletin RF-6 1O88JN 5M

BIDWELL®

CMI CORPORATION OKLA CITY USA

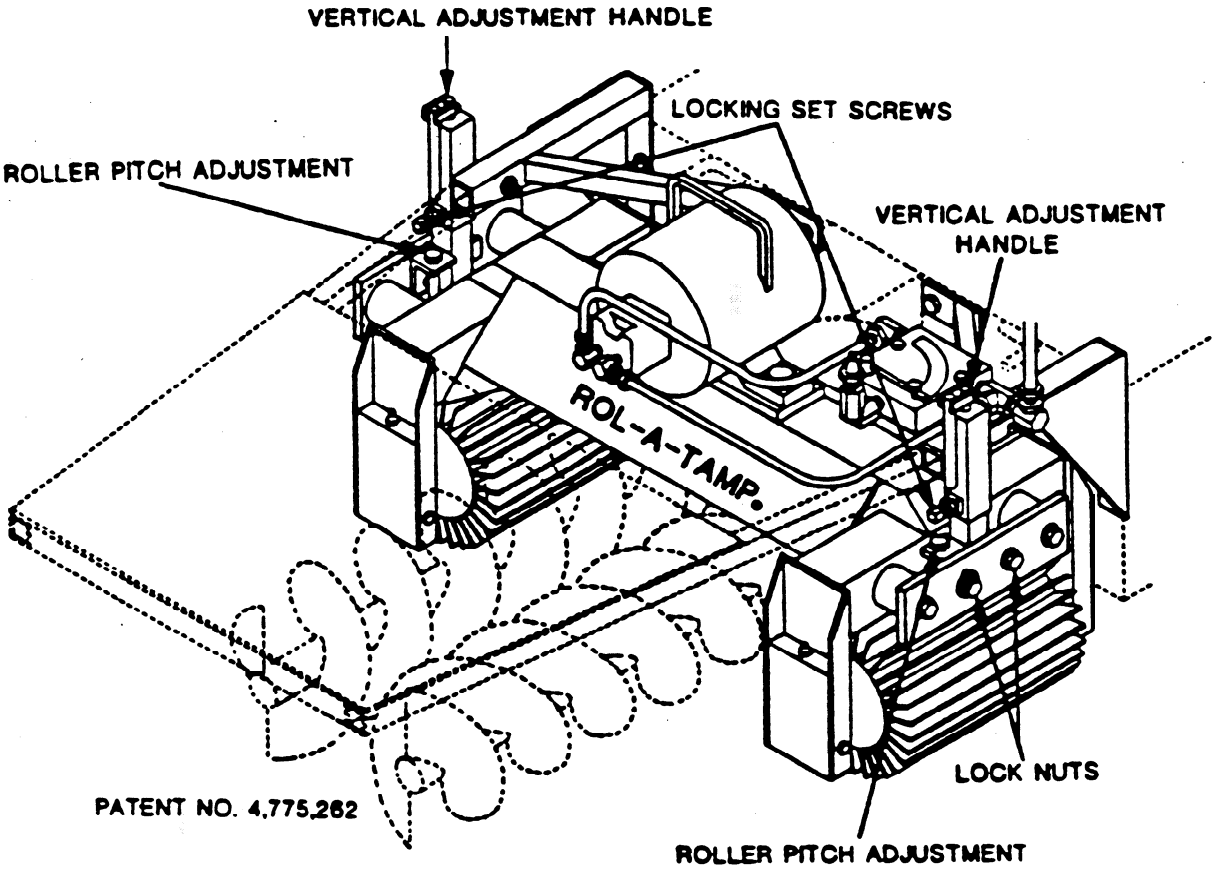
PAVING LATEX MODIFIED CONCRETE



P.O. BOX 97 CANTON, SOUTH DAKOTA 57013 AREA CODE 605 PHONE 887-2603 TELEX 295001 FAX 605-987-2605

VIBRATING ROL-A-TAMP

The Bid-Well Rol-A-Tamp Paving Attachment provides a means of achieving a more uniform concrete surface with desired density. This helps difficult to finish concrete due to unpredicatable delays, low slump specifications and wind exposure causing surface drying.



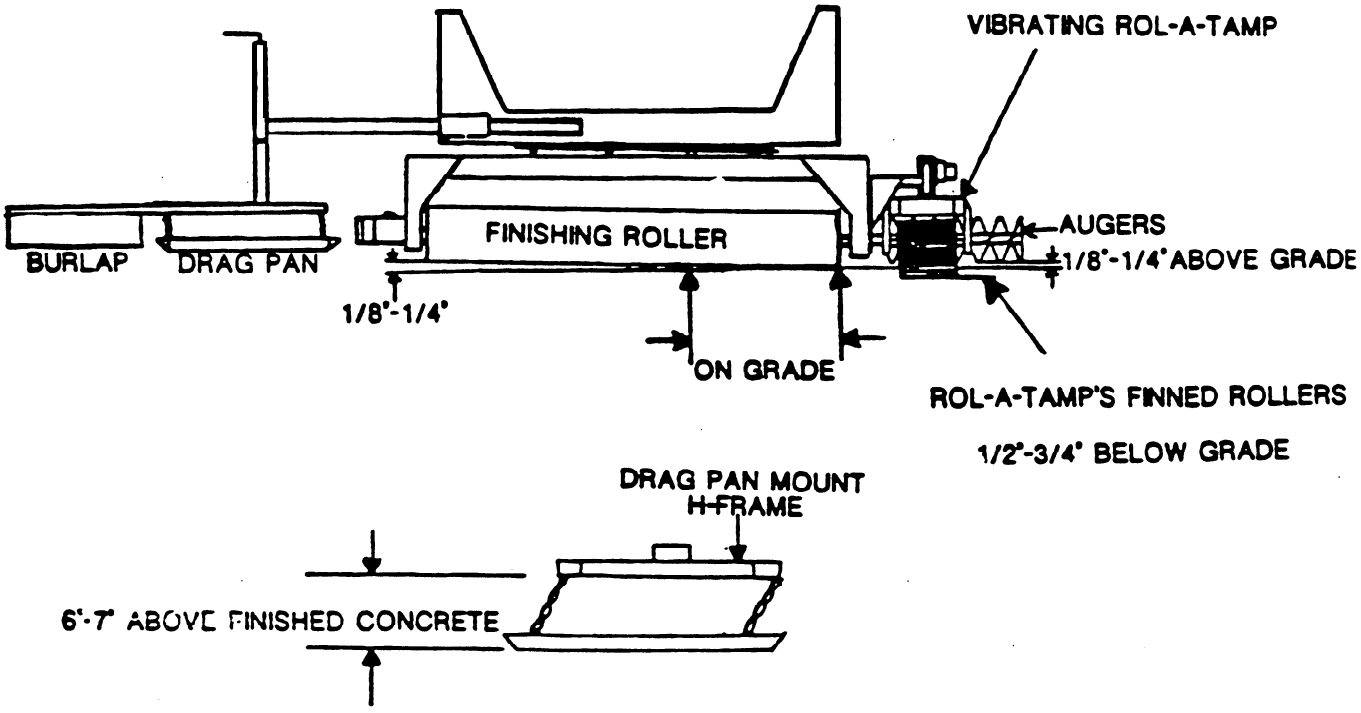
VIBRATING ROL-A-TAMP CONTINUED

With the Bid-Well Rol-A-Tamp paving attachment, the machine has the method of striking-off, vibrating and finishing (sealing) the surface of the Latex Modified Concrete.

The Roller Tamper, which mounts from the finishing carriage, utilizes two free-wheeling finned rollers, 11" long - 7 l/2" O.D. with fins 1" long 3/16" thick. The finned rolleri are positioned between the leveling augers and finishing rollers can be adjusted horizontally and vertically.

Vibration is provided to prevent concrete from adhering and building up on the fins but also helps to obtain a more uniform and consolidated surface.

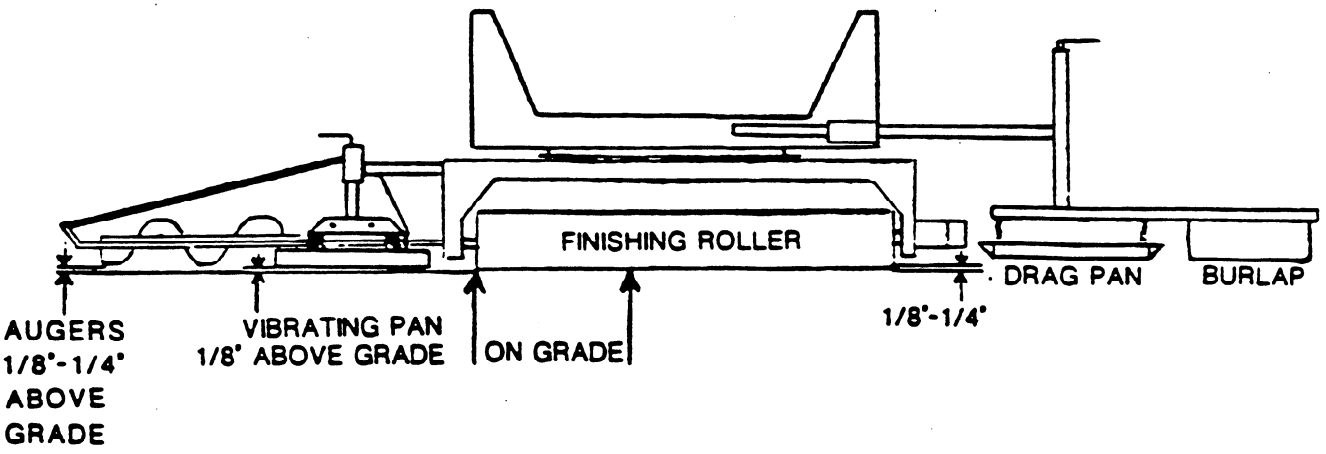
The Vibrating Rol-A-Tamp's finned rollers are set approximately l/2" - 3/4" below finished grade. The vibration of the Rol-A-Tamp should run between 4000-5006 vibrations per minute, this can be - checked with a vibra tak that is provided with the Rol-A-Tamp attachment. Then the finishing rollers set to grade seal the surface of the Latex Modified Concrete. As soon as the finishing rollers pass over the starting bulk head, the rear of the rollers should be raised a minimum of l/8" to l/4". This will allow maximum roller contact with the material. It may be of some benefit to have minimal contact of finishing roller with the material with the Latex material, as it will prevent sticking and some tearing if the material is drying rapidly on the surface. The raising of the rollers is accomplished by turning the rear leg cranks 1 full turn counter clockwise for each l/4"; l/2 turn for l/8". The finishing pan and burlap drag (soaked in a water or latex water mixture) are used to insure a good surface seal.

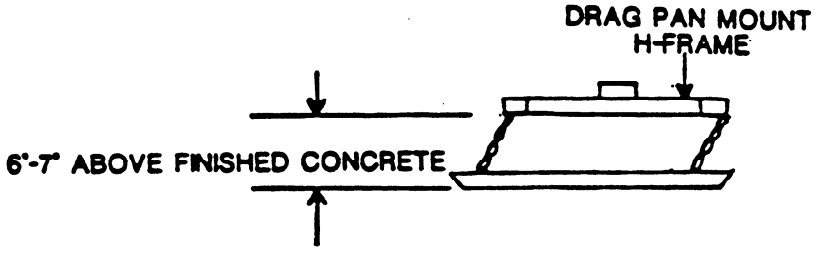


VIBRATING PAN

The paving machine should have the method of metering, vibrating and finishing the surface of the Latex Modified Concrete: With all functions properly adjusted, the augers will meter the concrete approximately l/8"-l/4" above the finished grade, the vibrating pan set approximately l/8" above finished grade and the finishing rollers on grade, it will result in leaving the right amount of-material for the finishing rollers to seal any open areas in the surface, without the vibrating pan or rollers having to plow or move excess concrete. This will also improve consolidation by the pan vibrator, with normal operating speeds from O-7000 vibrations per minute with normal speeds of 4000-5000 VPM yielding the best results.

The finishing pan and burlap drag (normally soaked in water or wetted with a mixture of latex and water) behind the finishing rollers, will help insure s good surface seal.





PAVING LATEX MODIFIED CONCRETE

1) It is very-important that the machine has a straight and solid set of rails to run on. It is our experience that round pipe is superior to square tubing or beam rails. We recommend 2" schedule 80 black iron pipe, with the use of low profile overlay adjustable chairs spaced at 24" on center. l The pipe is easier to align, to set into the chairs and confirms to radius turns better than any other type of rail. The slab or finish grade can be no better than the grade of the rails as they give the longitudinal profile.

2) If the overlayment is to be made in several passes a nail strip is commonly used to help maintain a straightline adge and to keep the outer edge' from slumping. It is also a means of not wasting excess material. **REMEMBER: DO NOT** place material over 3 to 5 ft. in front of the machine.

3) The vibration or frequency of the attachments is easily controlled on the front of the carriage. This permits changing the speed to match the requirements of the job, slump, depth of our mix designs. With the vibrator properly adjusted or set to speed, the attachments will tend to make the material more uniform with desired density, removing air pockets and voids.

4) For maximum production and best machine performance every effort should be made to control the quality and consistency of the concrete to be delivered or placed. Particularily variations in slump will result in less than optimum performance. Deep holes or partial depth pockets should be filled to nominal scarafied grade and vibrated with hand vibrators.

5) The finishing process should normally be complete, as soon as possible by the machine in a period not normally to exceed ten minutes from the time of placement of the concrete to finish, as the set-up time or the time that the film or latex skin forms on the surface is generally 10-15 minutes in time, with the normal slump of 4 l/2-7 inches. This will give adequate time for hand finishing along curb edges and the texturing desired or required, before the surface film art skin forms.

6) Due to the nature of latex modified concrete temperature and wind become very much a factor. With a temperature of 85 degrees Fahrenheit, the pouring of latex modified concrete is not recommended. A high or constant wind will aid and speed the set-up time, causing problems with the finishing process, tearing open the surface caused by latex buildup on the rollers; therefore, is not recommended.

PAVING LATEX MODIFIED CONCRETE

continued

When placing Latex Modified Concrete onto the deck surface, make sure that the deck is prewetted; not having a chance to dry out. Using some of the material placed, spread it out onto the deck and broom it into the deck surface ahead of the machine, removing the majority of the large aggregate, This should leave the deck covered with a latex slurry an all aggregate removed. Brush the slurry up onto curbs or adjoining slabs a minimum of 3 inches to insure a good bond. DO NOT place material more than 3 to 5 feet in front of the machine as it can dry out.

CARRIAGE TRAVEL SPEED

To control carriage travel speed is a must and an advantage, especially when doing Latex Modified Concrete Overlays. Much study has been done as to the effect of the speed of the finishing member passing over the surface of the latex. Not only does the slowing down *of* the carriage travel (Bid-Well recommends somewhere in the 60-65 feet per minute range) improve the overall overlay problems, it also -will allow the finishing rollers to have longer contact with the initial surface and do a better job of sealing. It may be a benefit to also slow the speed of the finishing rollers also. The pour rate is not changed as the advancement of the machine may increase to compensate for slower carriage travel.

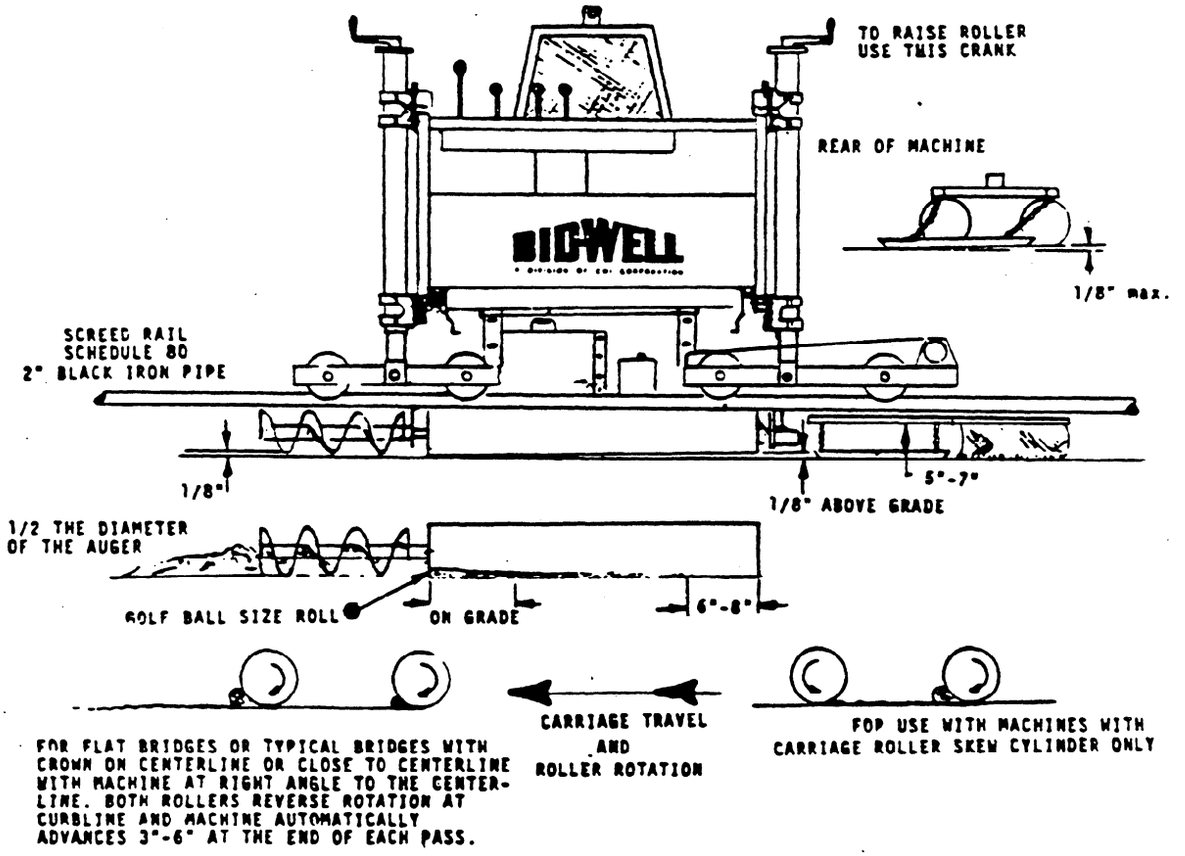
FINISHING ROLLER DIRECTIONAL ROTATION

At times It may become an advantage to be able to change the direction of the finishing rollers.

*Normal rotation is to have both rollers turning in the same direction when paving on straight or flat surfaces with the rollers reversing direction at the end of each carriage pass.

By changing direction of one or both rollers it may be an advantage to have the first roller or leading roller, roll over and consolidate the aggregate and the second roller finish the surface with out the rollers ever reversing direction.

ROLLER ROTATION DIRECTION
CARRIAGE TRAVEL DIRECTION



LATEX MODIFIED CONCRETE OVERLAY

TROUBLE SHOOTING PAVING PROBLEMS

SYMPTOM	Excess concrete on vibrating pan (plowing concrete). Excess concrete roll on finishing rollers.
CAUSE	Augers set to high.
REMEDY	Adjust augers lower, this will leave just enough concrete to allow the vibrating pan to vibrate the material and the finishing roller to have a mall size roll of concrete on it, to seal the surface.
SYMPTOM	No concrete on vibrating pan. No concrete on finishing roller.
CAUSE	Auger set too low.
REMEDY	Raise augers-to above remedy procedure.
SYMPTOM	No concrete in contact with vibrator pan and excessive concrete on finishing rollers.
CAUSE	Auger set too high - vibrator pan set too high.
REMEDY	Lower augers and pan to remedy procedure stated above.
SYMPTOM	Excessive amount of concrete on vibrating pan (plowing the concrete). No concrete or roll on finishing rollers.
CAUSE	Augers and vibrating pan set too low.
REMEDY	Raise augers and vibrating pan to remedy procedure stated above.
SYMPTOM	Open or pitted surface from finishing rollers.
CAUSE	Finishing rollers carrying too much concrete (roll is too large on side of rollers). The carriage travel speed may be too fast, or the material may be placed on 'the deck too fat in front of the finishing machine.
REMEDY	Adjust augers and pan as stated above, reduce carriage travel speed with carriage speed control valve, and reduce the length or distance in front of the machine where the material is placed, also checking slump to make sure it is within specification - normally 4 1/2 Inches to 7 inches.

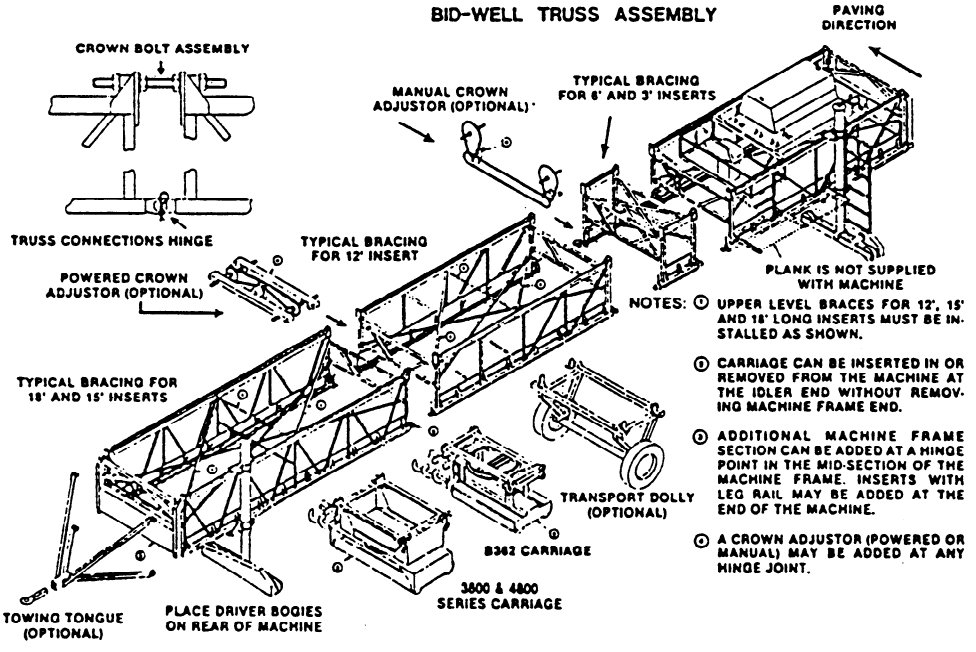
TROUBLE SHOOTING CONTINUES

SYMPTOM	Roll of grout coming off the rear of the finishing rollers or rollers leaving a ridge in the slab.
CAUSE	The rear or back of the machine is too low.
REMEDY	Raise the back or rear of the machine until the excess roll or ridge disappears (normally the back end of the finishing rollers will be 1/8 inch higher than the front or leading end of the finishing rollers).'
SYMPTOM	Raise or finishing pan is leaving an indention in the surface at the slab edge.
CAUSE	There may be too much additional weight on the finishing pan or the pan my be being pulled at a point too high by the pan hanger frame.
REMEDY	Remove the added weight (usually concrete on the pan) from the pan and readjust the height from the top of the pan to the bottom of the H or hanger frame to approximately 7 inches.
SYMPTOM	The total finished surface behind the finishing pan is not 100% seal cd.
CAUSE	?
REMEDY	The use of a burlap drag is suggested, keeping the burlap damp at all times.

BID-WELL®

CMI CORPORATION OKLA CITY USA

ROLLER PAVER SET-UP INSTRUCTIONS AND PAVING PROCEDURES



BID-WELL P.O. BOX 97 CANTON, SOUTH DAKOTA 57013 AREA CODE 605 PHONE 967-2603 TELEX 295001 FAX 605-987-2605

ASSEMBLING YOUR BID-WELL ROLLER PAVER

(To Be Used With Manual)

FOR ADDITIONAL HELP CALL BID-WELL (605)987-2603

A CAUTION:

1. **Put safety first - read operators manual.**
2. **Assemble machine with all cross braces and safety shields - consult owners manual for safe lifting.**
3. **Clear machine of all personnel before starting and operating.**
4. **Stop engines before cleaning machine.**
5. **Never take safety for granted.**

With all of the preparation, time and money spent in putting up the sub structure of a bridge or the dirt work involved in preparing the sub grade of a roadway. The most important factor of a good concrete pour is the set up of the paving machine.

The assembly and adjustments of the Bid-Well Roller Paver can normally be accomplished by two men with a good set of hand tools and some type of lifting device capable of lifting the machine safely.

When assembling the machine, check if there is a crown in the deck or roadway. It is ideal to have hinge point of the truss frame directly above the crown point. For machines over sixty feet in length, machine truss frame stress can be minimized by placing the shortest inserts near the end sections of the machine when possible.

After the assembly has been completed and the machine is ready to be placed on the deck, a Pre-placement check-out should be done both mechanical and hydraulic.

The mechanical checkout should include an inventory of all attachments for the machine. Augers, right and left hand, auger guard and drag pan assembly. The machine should be checked to make sure it is operational, that is, by running the carriage travel, paving rollers and augers and also machine travel or running the travel bogies,

The hydraulic checkout should be done at the same time. Checking of engine oil and hydraulic pump seals, and hydraulic oil reservoir levels.

Also check hydraulic quick disconnects to make sure they are fully connected and also check hydraulic hoses for damaged or worn spots, If any are found, the hoses should be replaced.

The pre-placement checkout should also include the screed rail or pipe and paving forms. This is one of the most important factors in obtaining a good pour.

The paving form or screed pipe must be accurate and conform to the grade required. For the screed pipe or rails, Bid-Well recommends a 2" schedule 80 pipe and adjustable chair supports spaced 24” on centers.

LIFTING AND PLACING THE MACHINE

When lifting and placing the machine onto the screed pipe or paving forms, reasonable care and judgement should be used.

Make sure to consult the manual for recommendation when lifting the machines longer than the basic 36' length.

Also use lifting clevis provided with the machine.

Once the machine has been placed on the screed pipe or paving forms and positioned for initial set up with the carriage and paving rollers centered on-the machine, make sure all attachments are assembled onto the machine. Start by setting all four corners of the machine, using the leg cranks, making sure the top edge of the carriage rail is the same distance from the top of the screed rail or paving form on all four corners of the machine. (Refer to fig. 1)

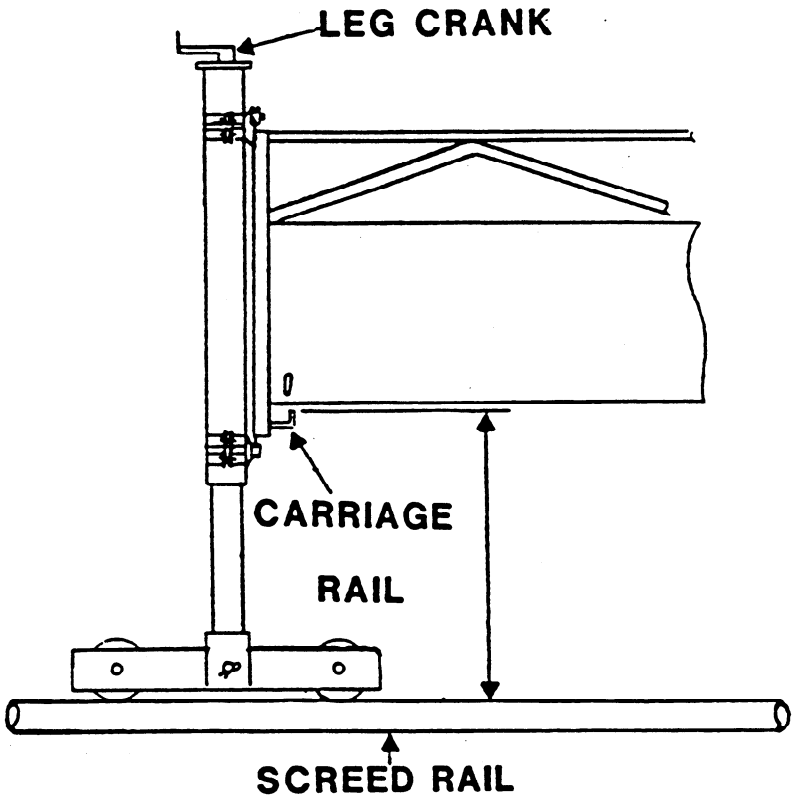


FIG.1

STRAIGHTENING THE TRUSS FRAME

The truss frame of the machine should now be straightened. All attachments, augers, guards, drag pans and all other options, if any should be installed on the machine at this time, with the carriage positioned in the center of the machine.

If catwalk is desired it should be in place to allow for any and all natural deflection in the truss frame. Note: Catwalk is recommended for use only on the main power unit section of the machine.

By using a masonary line of at least 120# tension, tie the string line to the eyebolts located on all four corners of the end panels of the machine. (Refer to fig. 2)

After the string line has been pulled as tight as possible by hand loosen up the inside nut of the eyebolt and back-the nut all the way out to the end of the threads, Then tighten-the nut on the back side to pull the string even tighter.

Measure from the bottom of the carriage rail to the bottom cord of the truss frame. (Refer to fig. 3). Make sure this measurement is the same at all four corners and every hinge point. Nominal is approximately 1 l/2" (one and one half inches).

Next, using five identical wood blocks (2"x6") or something of equal height, place one at every corner of the machine between the string and the carriage rail. (Refer to fig.4)

With the fifth block go to each hinge point, and by adjusting the crown bolts, raise or lower the truss frame until the string just touches the block.

Then double check by eyeball to ensure the truss frame is straight. A 10 Foot straight-edge may also be used for final checking.

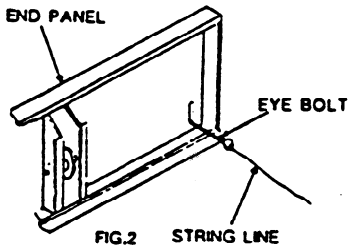


FIG.2

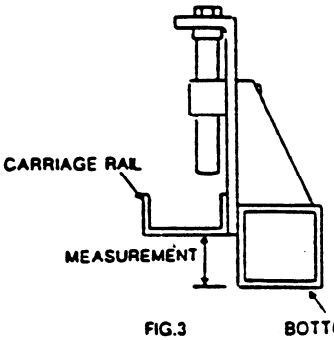


FIG.3

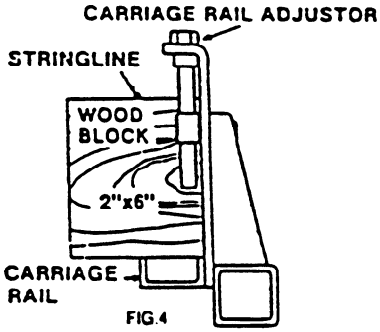


FIG.4

STRAIGHTENING THE CARRIAGE RAIL

This procedure, along with straightening the truss is very critical as it gives the transverse profile of the concrete surface. Use the same string line and wood blocks that was used in straightening the truss frame. Go to each rail adjuster and loosen the l/2" lock nut ONLY l/2 turn. Then by using the adjusting bolt, raise or lower the carriage rail just so the string line touches the top of the wood block. Be sure to retighten all the lock nuts.

ALIGNING THE PAVING ROLLERS

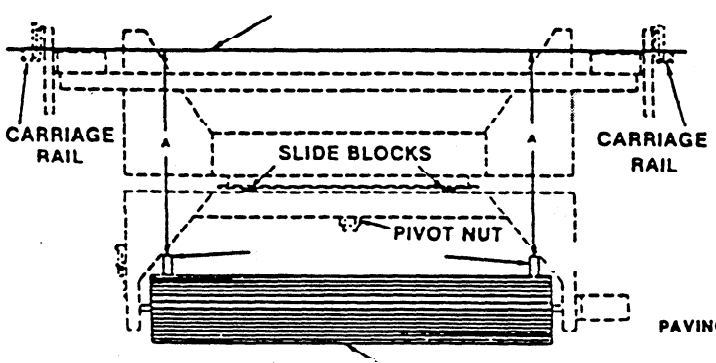
To, adjust the paving rollers and make them parallel to the carriage rail, first check making sure that all slide blocks are in contact with the skew ring of the upper carriage, If they are not all in contact with the skew ring, tighten the turntable pivot nut until the slide blocks make contact.

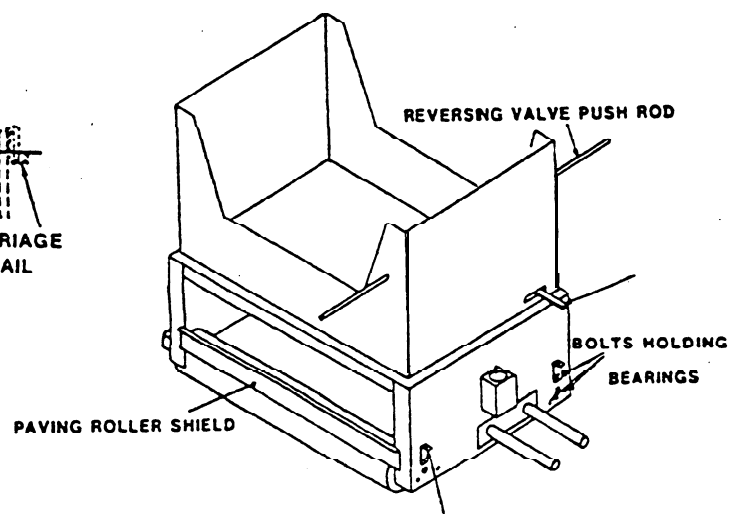
Start the engine of the carriage and engage the on/off lever. Then by pushing or pulling the reversing valve push rod to engage the skew cylinder to skew the lower carriage, adjust the pivot nut until the lower carriage skews freely. When satisfied that it does, shut off the engine and replace the cotter key locking the pivot nut.

Physically align the lower carriage so that it is parallel with the upper carriage.

Remove the paving roller shields, stretch a string line along each side of the upper carriage on the top side of the carriage rail, making sure the string contacts the inner flange of the channel rail. Then using a four foot level as a straight edge, lay it across the top of the paving rollers and measure up to the string line, making all four corners of the paving rollers the same measurement, by using the paving roller adjustment bolts, to adjust the rollers up or down.

Be *sure* to loosen the bolts holding the paving roller bearings in the front of the carriage and the three bolts holding the motor mount plates on the rear of the carriage before turning the adjustment bolts. After all adjustments are made and double checked, retighten all bolts and replace the paving roller shields.

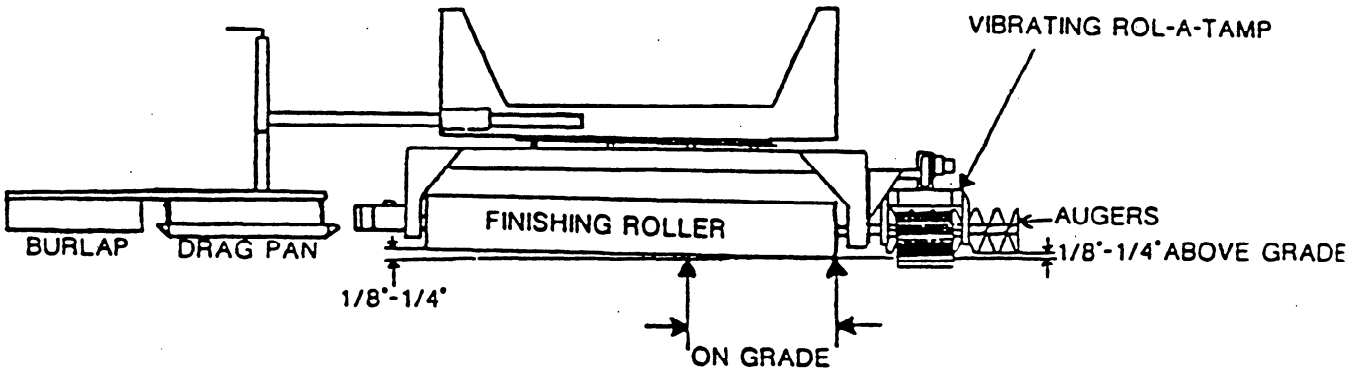


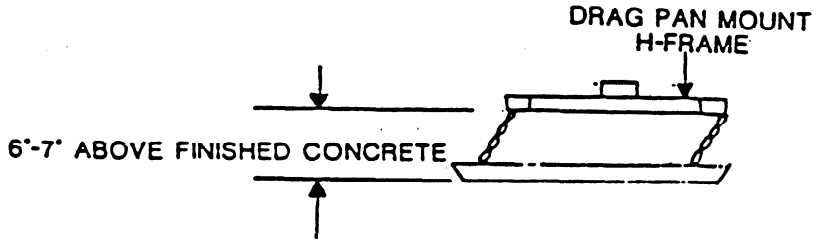


DRAG PAN & AUGER ADJUSTMENTS

The drag pan and astro grass, or burlap drag should be attached at this time adjusting the "H" frame for the pan mount to be approximately 5"-6" above the bottom of the finishing rollers, parallel to the rollers. The chain on the drag pan should be hooked in the 5th link from the end of the chain into the tabs on the H-Frame after the machine has advanced for enough into the pour for installation, The pressure for the astro grass or burlap drag assembly can be adjusted by rotating the square tubes on the rear of the H Frame. Add drag pan configurations.

The bottom edge of the auger flighting should be set (initially) approximately 1/8" - 1/4" above the bottom of the finishing rollers. The key to finishing success is to strike off the excess concrete with the augers and to finish the surface with spinning rollers.





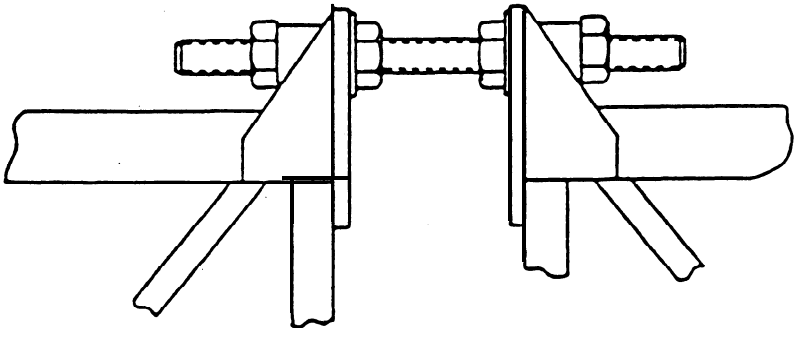
If a crown is required in the deck or slab, it is normally placed in the machine at a hinge point of the truss frame, by using the crown adjusting bolts.

At times due to numerous crown transitions in the roadway or bridge, the use of a powered or manual crown adjuster becomes very beneficial. (Contact the factory or area sales representative for further information concerning the powered, or manual crown ad juster option.)

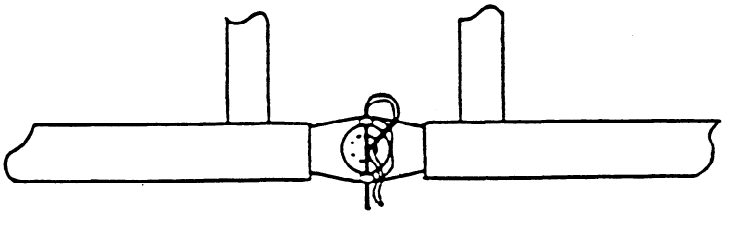
One method for placing a crown in to the machine is by measuring up from a grade point to the top of the carriage rail on both sides of the machine, noting the measurement. Taking the known amount of crown to be put into the truss, use the crown adjusting bolts to raise the center-of the machine to the desired crown, alternating from side to side on the crown bolts.

NOTE: Carriage should be placed at the crown point to allow for the natural deflection in the truss frame.

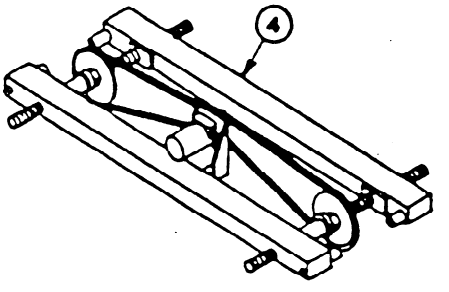
CROWN BOLT ASSEMBLY



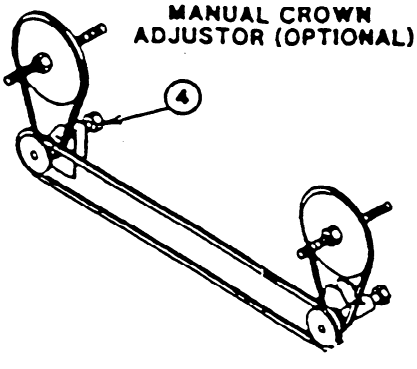
TRUSS INSERT HINGE



POWERED CROWN ADJUSTOR (OPTIONAL)



MANUAL CROWN ADJUSTOR (OPTIONAL)



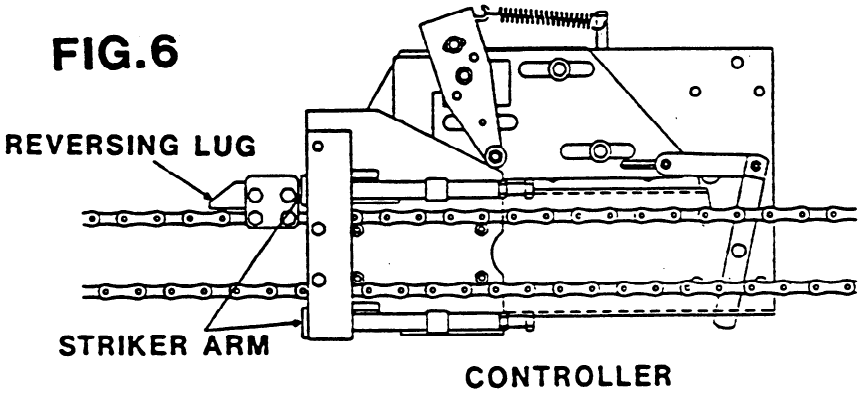
SETTING CARRIAGE TRAVEL

To set the machine for automatic carriage travel reversing, move the carriage to **one** end of the machine stopping it **approximately** 8 inches from the desired maximum paving width.

At **the controller** (refer to fig. 6), place the reversing **lug on** the chain as follows. If the carriage is at the opposite end from the controller, place the reversing lug onto the upper chain; with the carriage coming into the controller, the reversing **lug is on the** lower chain. NOTE: The lug is always placed onto **the** top of the upper chain and onto the bottom of **the lower chain,** with the flat or straight side against the striker arm. The reversing lug must always be attached **on** an outside **link.** Repeat the same procedure for the opposite end of the machine as found in paragraph 1.

When satisfied with the carriage travel settings, move the carriage to one end of **the** machine and as the carriage stops and is about to reverse direction (its maximum travel), stop the carriage from the operator's console. Slide the carriage reversing paddle (refer to fig. 7) until it contacts the reversing rod, and depress the spring cushion approximately 1 inch to 1 l/2 inches, completely shifting the reversing* valve in the carriage. Tighten all bolts on the reversing paddle, **locking** it in place. Repeat the procedure for the opposite end of the machine.

FIG.6



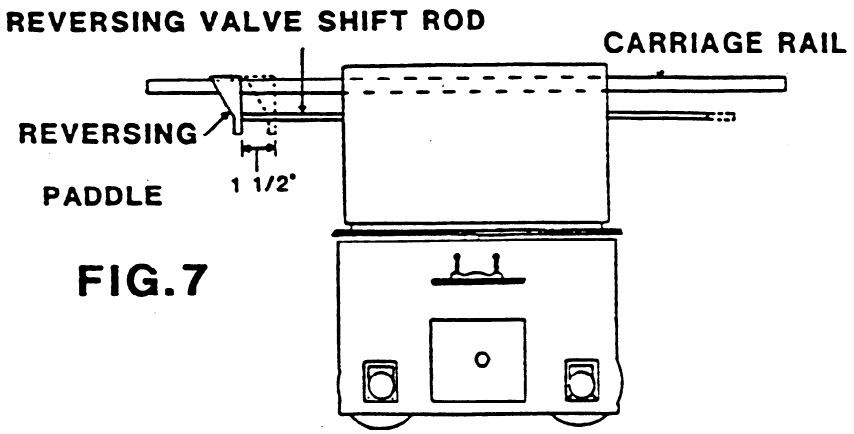


FIG.7

SETTING THE MACHINE TO GRADE

When setting elevation or grade of the paving rollers, move the machine to a place where the front end of the paving rollers are over-the top of a bulkhead, expansion joint or end dam that is on grade. Using the leg cranks, lower the machine so the paving rollers are slightly above or just touching the bulkhead, joint, or end dam. Move the carriage along the graded area from one side of the deck, to the other. When satisfied that grade of the paving rollers is correct both front and rear, check all legs front and rear by measuring from screed rail to the carriage rail. Dimensions should be the same front and rear on each end of the machine.

THE DRY RUN

After the machine has been set to grade, a dry run of the entire deck or slab should be performed. Checking bulkheads, end dams, expansion joints and depth checks can be done by inspecting personnel. During this time it allows the operator to become familiar with the controls and operation of the machine. If any corrections or adjustments are to be made, it is usually done by adjustments in the screed or pipe rail.

Before starting the pour, make sure that all gasoline tanks are full, hydraulic oil levels and engine oil has been checked.

PAVING PROCEDURES AND TIPS

After the pour has started and the machine has moved out from the end bulkhead or has passed over the bulkhead the full length of the paving rollers, raise the back of the machine l/8" by turning the back leg cranks l/2 turn counter clockwise. This will keep the rear of the paving rollers from-digging in and leaving a small ridge of concrete.

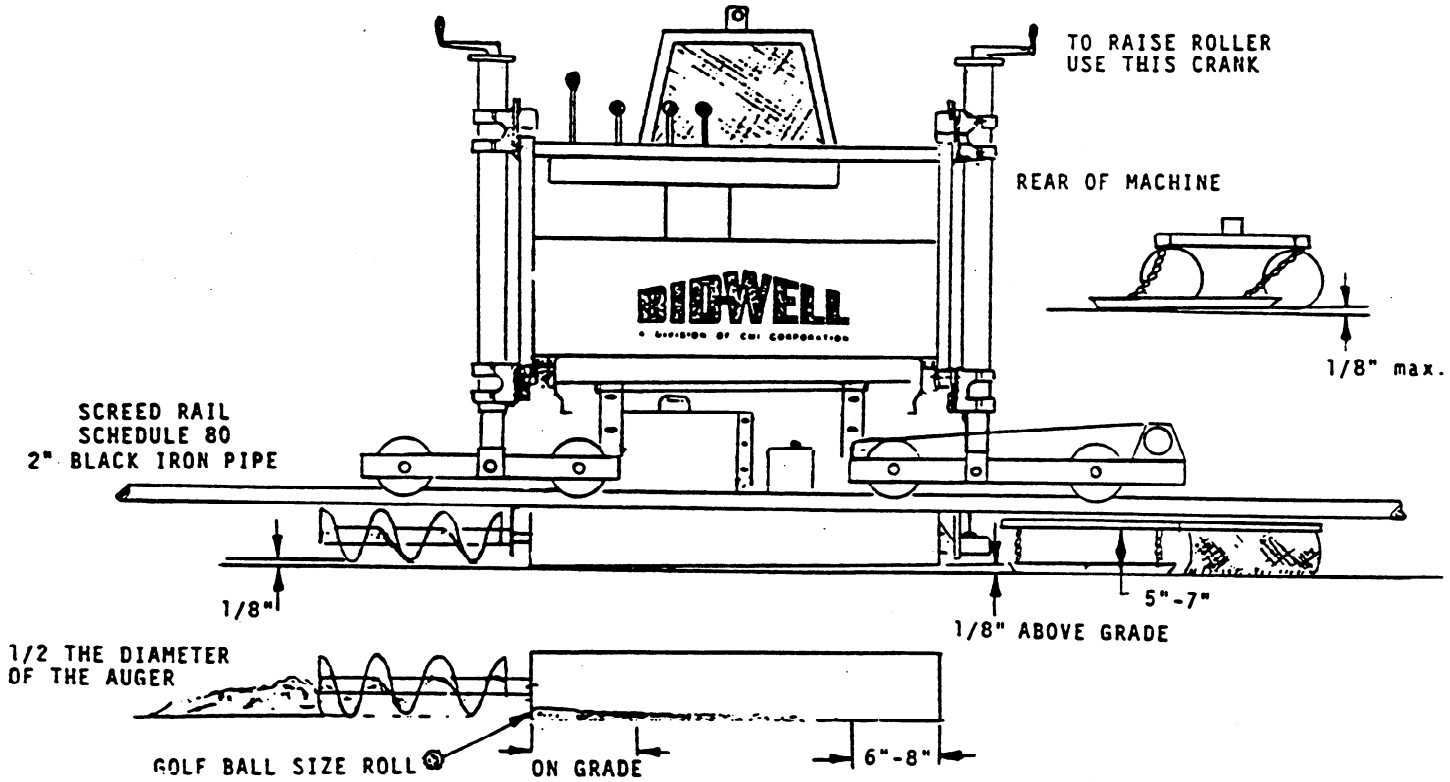
It may be necessary to readjust the augers up or down to obtain or reduce the roll of concrete (optimum is golf ball size in diameter at the front of the paving rollers). As the machine progresses into the pour and clears the bulkhead or end dam, attach the drag pan and astro grass or burlap drag.

When paving concrete going up hill, the back or rear of the 'machine should be raised slightly more than l/8". When paving down hill, the rear of the rollers should be lowered by using the rear leg cranks so there is nearly total contact of the paving rollers onto the slab or deck surface. The optimum roller setting is to have maximum surface contact, but not to leave a ridge or line of concrete coming off the rear of the paving rollers.

PAVING ROLLER ROTATION

Normal paving roller rotation at the beginning of a pour is both paving rollers turning in the same direction and reversing direction or rotation at the end of each carriage pass (for machines equipped with automatic roller reversing).

After progressing into the pour (for machines manufactured since 1984) it maybe an advantage to change direction of one of the paving rollers, viewing the rollers from either end. The right hand roller turns clockwise and the left hand roller turns counterclockwise. This allows the leading roller to roll over and consolidate the concrete, and the trailing roller to -pave or finish the surface without having both rollers reverse direction or rotation. Roller rotation of this manner (in most situations) will achieve a more sealed surface and eliminate excess concrete deposited into the gutter or drain line.



TROUBLE SHOOTING PAVING PROBLEMS

SYMPTOM	Excess concrete on paving rollers.
CAUSE	Augers set to high.
REMEDY	Adjust the augers lower, to obtain a golf ball size roll of concrete at the front of the paving rollers.
SYMPTOM	No concrete on paving rollers.
CAUSE	Augers. set to low.
REMEDY	Raise augers to obtain golf ball size roll of concrete at the front of the paving rollers.
SYMPTOM	Open or pitted surface from paving rollers.
CAUSE	Paving rollers are carrying too much concrete (roll is too large on side of paving rollers). The concrete may be placed out to far in front of the machine.
REMEDY	Adjust augers lower as stated above. Reduce the distance of material, in front of the machine (ideal placement in front of the machine is 6 to 8 feet in front of the machine).
SYMPTOM	Roll of grout coming off the rear of the paving rollers or rollers are leaving a ridge in the back.
CAUSE	The rear of the machine is to low.
REMEDY	Raise the rear of the machine by using the rear leg cranks until the ridge disappears. (Normally the rear of the paving rollers should be 1/8 of an inch higher than the front.)
SYMPTOM	The total finished surface behind the drag pan is not 100% sealed.
CAUSE	?
REMEDY	The use of a burlap drag is suggested, keeping the burlap damp at all times.

BID-WELL
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AREA CODE 605 PHONE 987-2603
TELEX 295001

ROLLER **PAVER SET-UP INSTRUCTIONS**

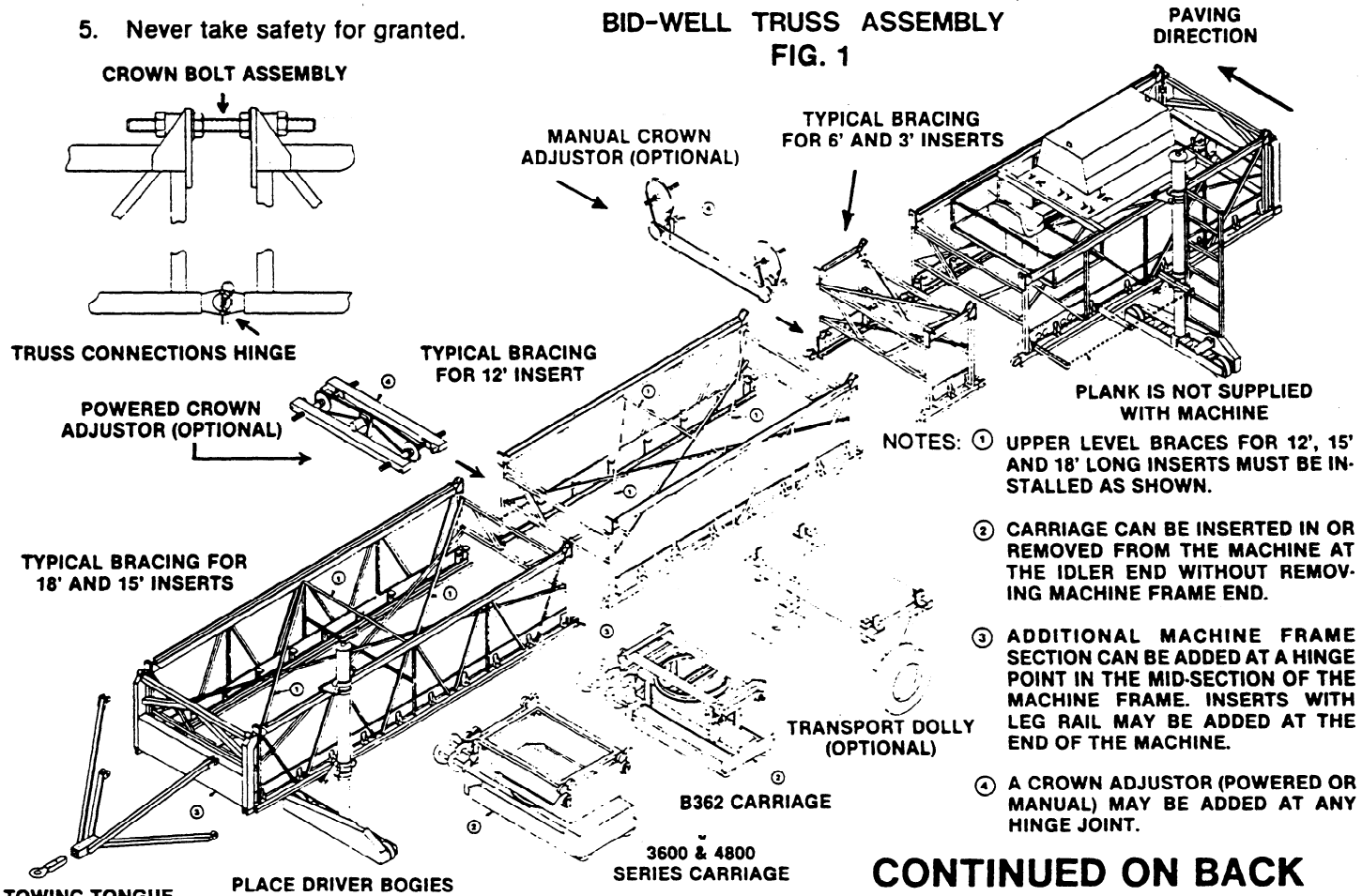
(To Be Used With Manual)

FOR ADDITIONAL HELP CALL BID-WELL (605)987-2603

⚠ CAUTION:

1. Put safety first - read operators manual.
2. Assemble machine with all cross braces and safety shields - consult owners manual for safe lifting.
3. Clear machine of all personnel before starting and operating.
4. Stop engines before cleaning machine.
5. Never take safety for granted.

BID-WELL TRUSS ASSEMBLY
FIG. 1



NOTES:
① UPPER LEVEL BRACES FOR 12', 15' AND 18' LONG INSERTS MUST BE INSTALLED AS SHOWN.
② CARRIAGE CAN BE INSERTED IN OR REMOVED FROM THE MACHINE AT THE IDLER END WITHOUT REMOVING MACHINE FRAME END.
③ ADDITIONAL MACHINE FRAME SECTION CAN BE ADDED AT A HINGE POINT IN THE MID-SECTION OF THE MACHINE FRAME. INSERTS WITH LEG RAIL MAY BE ADDED AT THE END OF THE MACHINE.
④ A CROWN ADJUSTOR (POWERED OR MANUAL) MAY BE ADDED AT ANY HINGE JOINT.

CONTINUED ON BACK

MACHINE SET-UP AND ALIGNMENT PROCEDURES

NOTE: MACHINE SHOULD BE ASSEMBLED ON GROUND BEFORE PLACING ON DECK

1. Assemble machine to fit job requirements - refer to diagram on page 1.
2. Install carriage and position at center of machine.
3. Mount bogies on legs - with drive bogies on rear.
4. **Position legs to fit** screed rails with hinge point over crown (see step 10.)
5. Consult owners manual for safe lift procedures, then lift and place machine on screed rails.
6. Remove truss frame twist with leg cranks.
7. Set carriage rails to the same relative mid-adjustor position at all corners and hinge points. Use carriage rail adjuster.
8. Set a stringline over the carriage rail above carriage wheels and adjust crown bolts at truss hinge points to straighten and align machine frame. (Fig. 2 & Fig. 1)

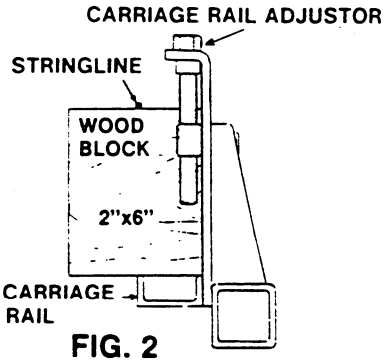


FIG. 2

CAUTION: COMPENSATE FOR STRING SAG - DO NOT USE PIANO WIRE.

9. Adjust carriage rail to stringline with adjustors. (Fig. 2). Set finishing rollers parallel to the carriage rails and to each other. (Fig. 3)
   A) Check and tighten turntable pivot nut to maintain contact at all four slide blocks.
   B) Stretch a stringline across top of carriage rail from front to rear on each side of carriage.
   C) Place a 4 ft. straight edge across ends of both rollers.
   D Measure down from stringline to top of straight edge at all four corners and adjust to same distance.

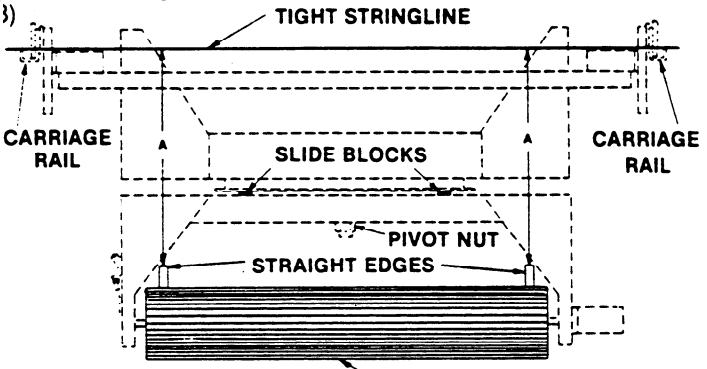


FIG. 3

10. Set crown by placing truss hinge point over crown and adjust by opening or closing top crown bolt. Consult owners manual for safe lift procedures, then lift and place machine on screed rails.
11. Attach reversing lugs to carriage travel chain for suitable paving width.
12. Attach roller reversing push rod activator plates to carriage rail - two inches inside maximum carriage travel width on each side.

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ROLLER PAVER OPERATING INSTRUCTIONS

NORMAL MACHINE OPERATION

1. Carriage travel direction automatically reverses at the end of each carriage pass.
2. Finish rollers automatically reverse rotation and skew slightly at the end of each carriage pass.
3. Machine automatically travels forward a preset distance at the end of each carriage pass.

FINAL GRADING ADJUSTMENTS

1. Set front and rear ends of finish rollers to final grade using leg cranks.

   EXAMPLES:

   A) Grade to a bulkhead, end dam or expansion joint.

2. Set augers approximately 1/8 to 1/4 inch above grade of rollers. Use crank with pin lock.
3. Dry run machine from end to end of pour to preload falsework and check bulkheads.

   A) Match grade of bulkheads and end dams by feathering screed rails, but do not change machine leg cranks

FINAL PAVING ADJUSTMENTS

1. Set rear end of finish rollers approximately 1/8 to 3/16 inches above front end by raising rear of machine 3/4 to 1. turn of leg crank.
2. Augers may need to be readjusted during the pour, to maintain a golf ball size roll of concrete at the front of rollers, which should feather out no more than half way back.
3. Rear leg setting may need to be readjusted at either side, during the pour, so rear of roller is just touching the concrete without leaving a mark.
4. Drag pans are attached to pull in either direction. Adjust to obtain a slight leading edge rise.
5. Astro turf or burlap drag may be attached and adjusted to give surface texture.

CONTINUED ON BACK

CAUTION Before starting machine, all safety shields to be in place, set all controls to off or stop position, and clear all personnel from machine.

TO START ENGINES

1) Set power selector level to 'stop'
2) Start engine and allow for warm-up -
3) Set engine to operating speed

TO TRAVEL MACHINE

1) Set machine travel direction control levers to direction needed
2) Set power selector lever to machine travel
3) Use machine travel speed lever to start, travel and stop machine

TO PAVE - CARRIAGE SETTINGS

1) Set power lever at end of carriage to 'run'
2) Set finish roller rotation direction with valves on rear of carriage so both rollers rotate up into concrete on each pass.

TO PAVE - CONTROL CONSOLE SETTINGS

1) Set machine travel direction control levers
2) Start carriage travel, by moving power selector lever to 'pave'
3) Select automatic machine advance distance with machine travel speed control

1) Slowly move power selector lever to 'stop'
2) Shift carriage travel reversing lever in direction of travel required
3) Slowly move power selector lever back to 'pave'

TO STOP AUTOMATIC FINISH ROLLER REVERSING

1) Pull valve knob out on side of carriage
2) Set finish roller rotation in desired direction with valves mounted on rear of carriage (for Model 362, change quick disconnect hoses)

TO STOP AUTOMATIC SKEWING OF FINISH ROLLERS

1) Disconnect skew cylinder by removing mounting pin and secure skew ring clamps.

CMI BID-WELL

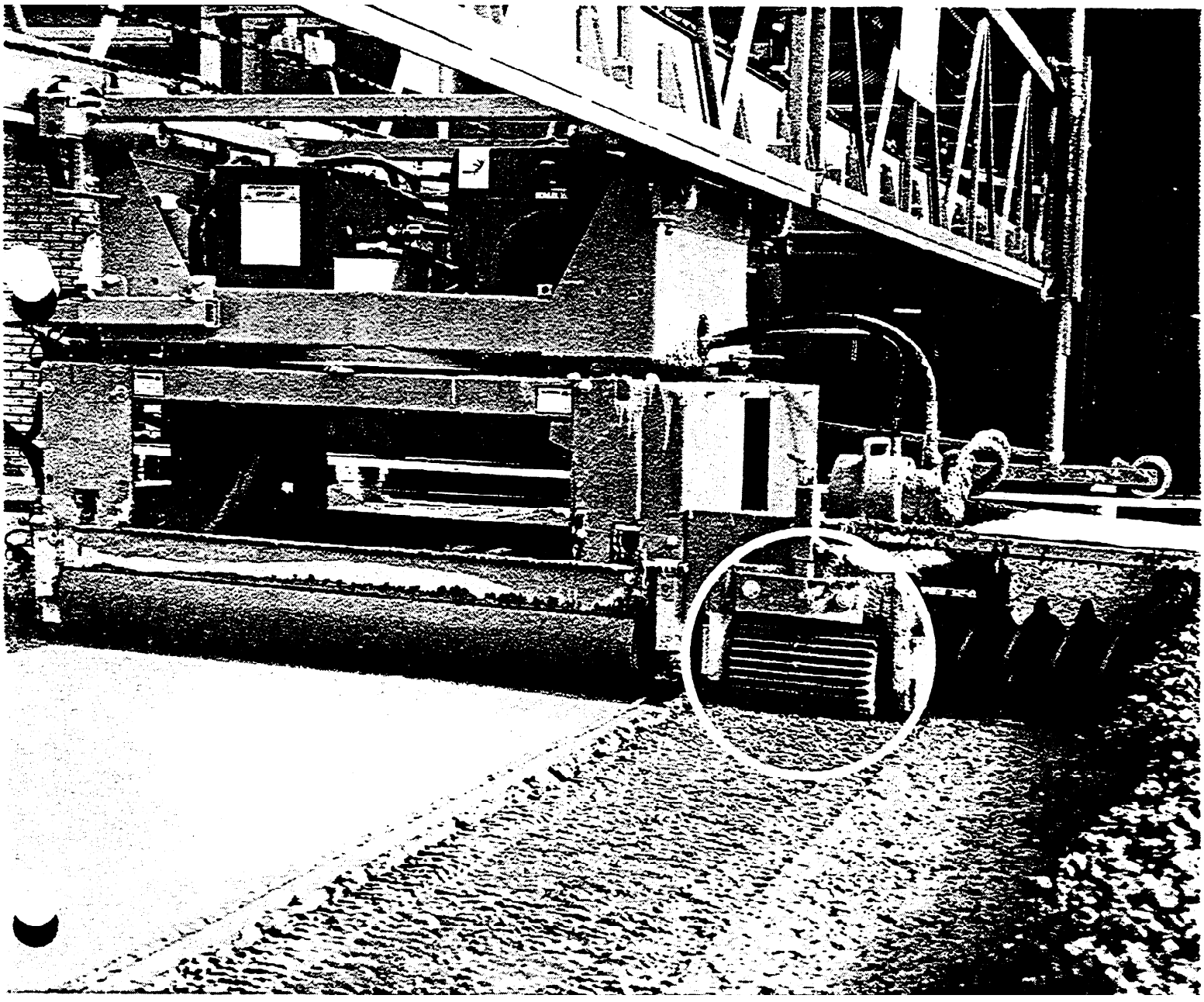
ROL-A-TAMP

for the BID-WELL ROLLER PAVER

The BID-WELL Rol-A-Tamp finishing attachment provides a means of achieving a more uniform concrete surface with desired density. This facilitates sealing difficult to finish concrete due to harsh mix designs, unpredictable delays, low slump specifications, and wind exposure causing abnormal surface drying.

The R&A-Tamp, which mounts from the paving carriage, utilizes two freewheeling finned rollers. The finned rollers can be leveled horizontally and adjusted vertically.

Vibration is provided to prevent concrete from adhering to or building up on the finned rollers. The vibration also helps to obtain a more uniform and consolidated surface.

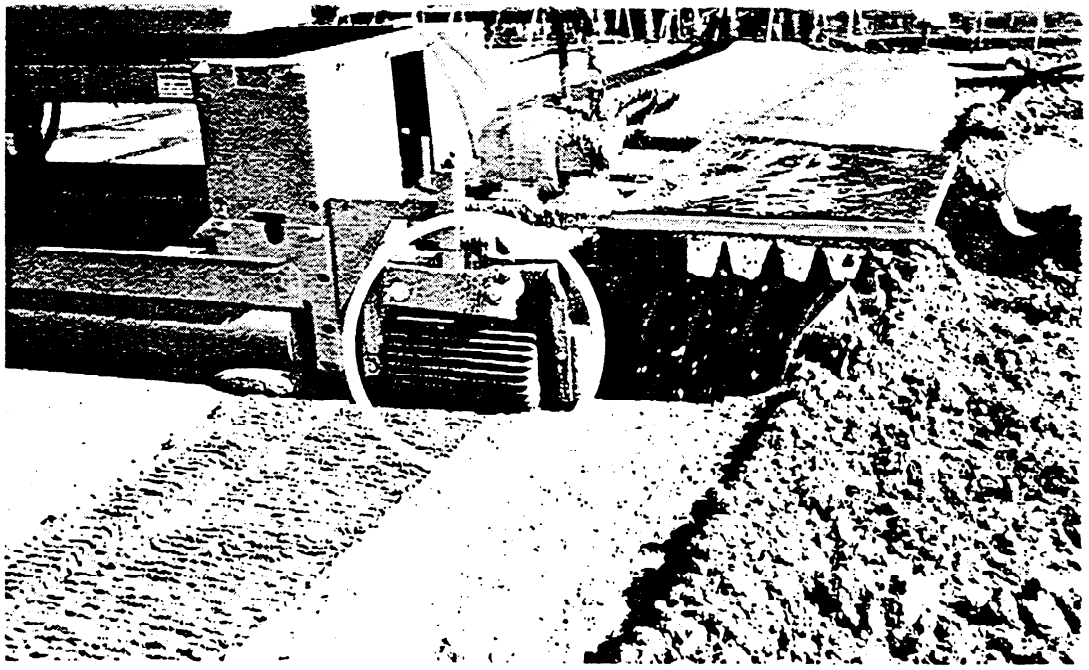


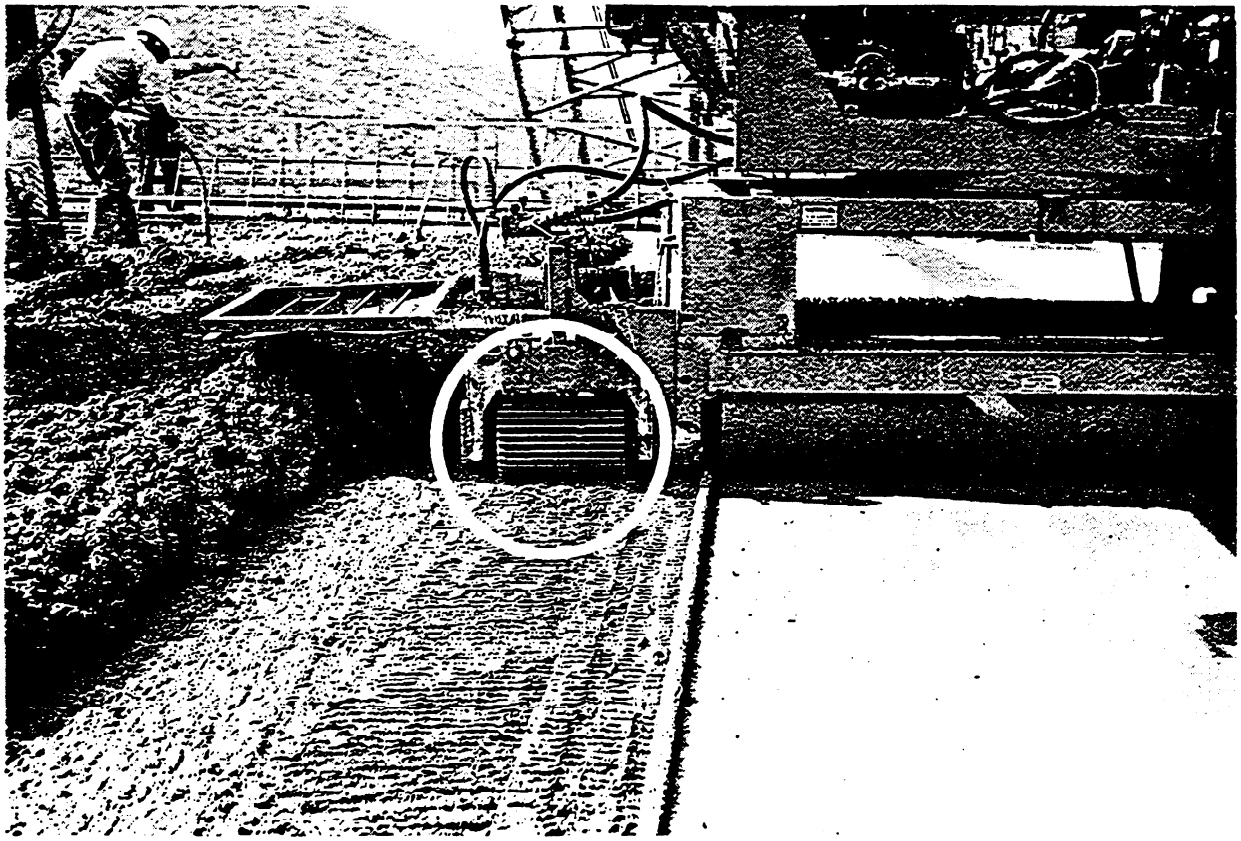
BID-WELL®

ROLLER TAMPER

AVAILABLE ON
48202, BR202, 36202
MODELS

patent pending





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ROL-A-TAMP SET UP INSTRUCTIONS

(To Be Used With Manual)

FOR ADDITIONAL HELP CALL BID-WELL (605)987-2603)

⚠ CAUTION:

1. Put safety first - read operators manual.
2. Assemble machine with all cross braces and safety shields - consult owners manual for safe lifting.
3. Clear machine of all personnel before starting and operating.
4. Stop engines before cleaning machine.
5. Never take safety for granted.

SPECIFICATIONS FOR BID-WELL ROL-A-TAMP

The BID-WELL Rol-A-Tamp finishing attachment provides a means of achieving a more uniform concrete surface with desired density. This facilitates sealing difficult to finish concrete, due to harsh mix designs, low slump specifications, wind exposure causing abnormal surface drying and unforseen and unpredictable delays.

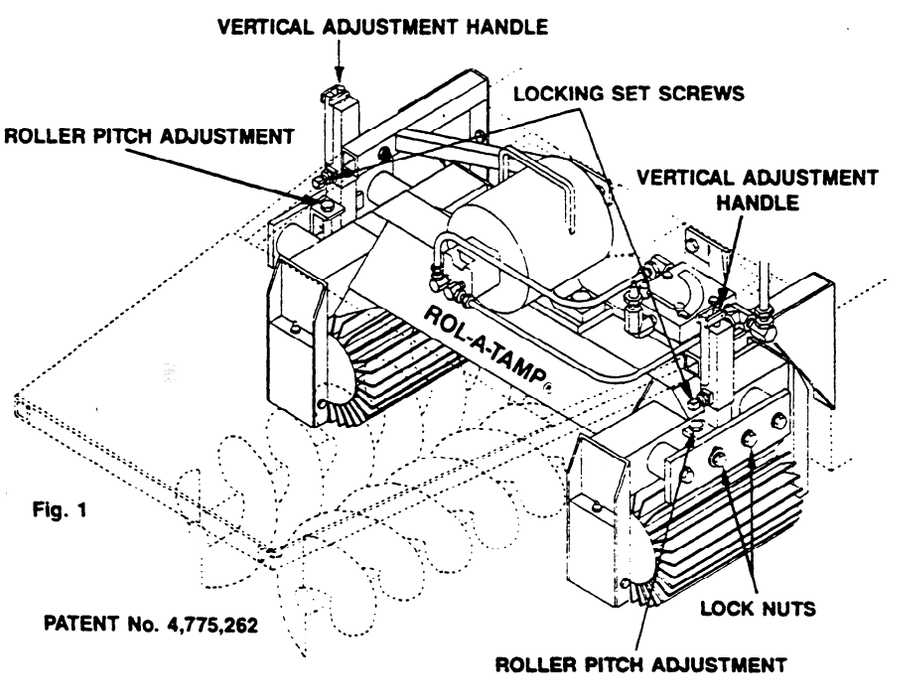

Fig. 1

PATENT No. 4,775,262

CONTINUED ON BACK

ROL-A-TAMP SETUP AND ALIGNMENT PROCEDURES

The Rol-A-Tamp's finned rollers are vertically adjustable from 1/2 inch above concrete grade to 1/8 inch below concrete grade. The depth of penetration can be varied, according to job requirements. A 1/8 inch penetration will normally yield good results.

1. Place a four level under the finishing rollers and under the Rol-A-Tamp. Refer to fig. 2.
2. Loosen locking set screws. Refer to fig. 1
3. Loosen lock nuts for-the roller pitch adjustment. Refer to fig.1
4. Set the front of the rollers approximately 1/8 of an inch higher than the rear of the rollers, by using the pitch adjustment. Refer to fig. 1
5. Pitching the front end of the finned rollers up 1/8 to 1/4 of an inch allows the Rol-A-Tamp to become parallel to the concrete surface, when the rear of the machine is raised using the rear leg cranks.
6. Lower the finned rollers by using the vertical adjustment handles. Refer to fig. 1
7. Set the finned rollers to 1/8 of an inch below the finishing rollers or desired depth. Refer to fig. 3. Maximum recommended depth 3/16.
8. Lock all set screws and lock nuts.
9. Run the vibrator at the speed that does the best job of keeping the fins of the rollers clean. (Do not exceed 5000 vibrations per minute, normally 3500-4500 VPMS is a good operating speed)

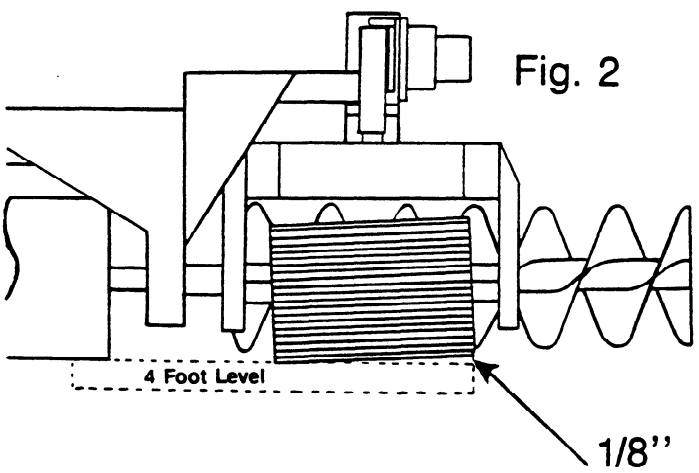

Fig. 2

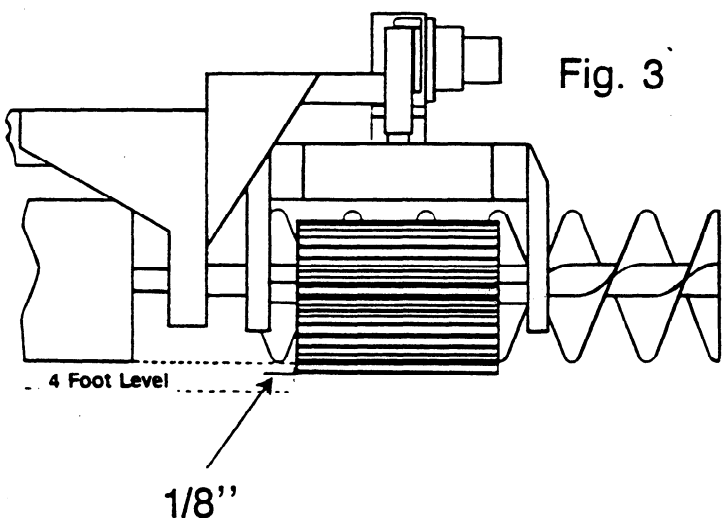

Fig. 3

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SPECIFICATIONS FOR BID-WELL ROL-A-TAMP

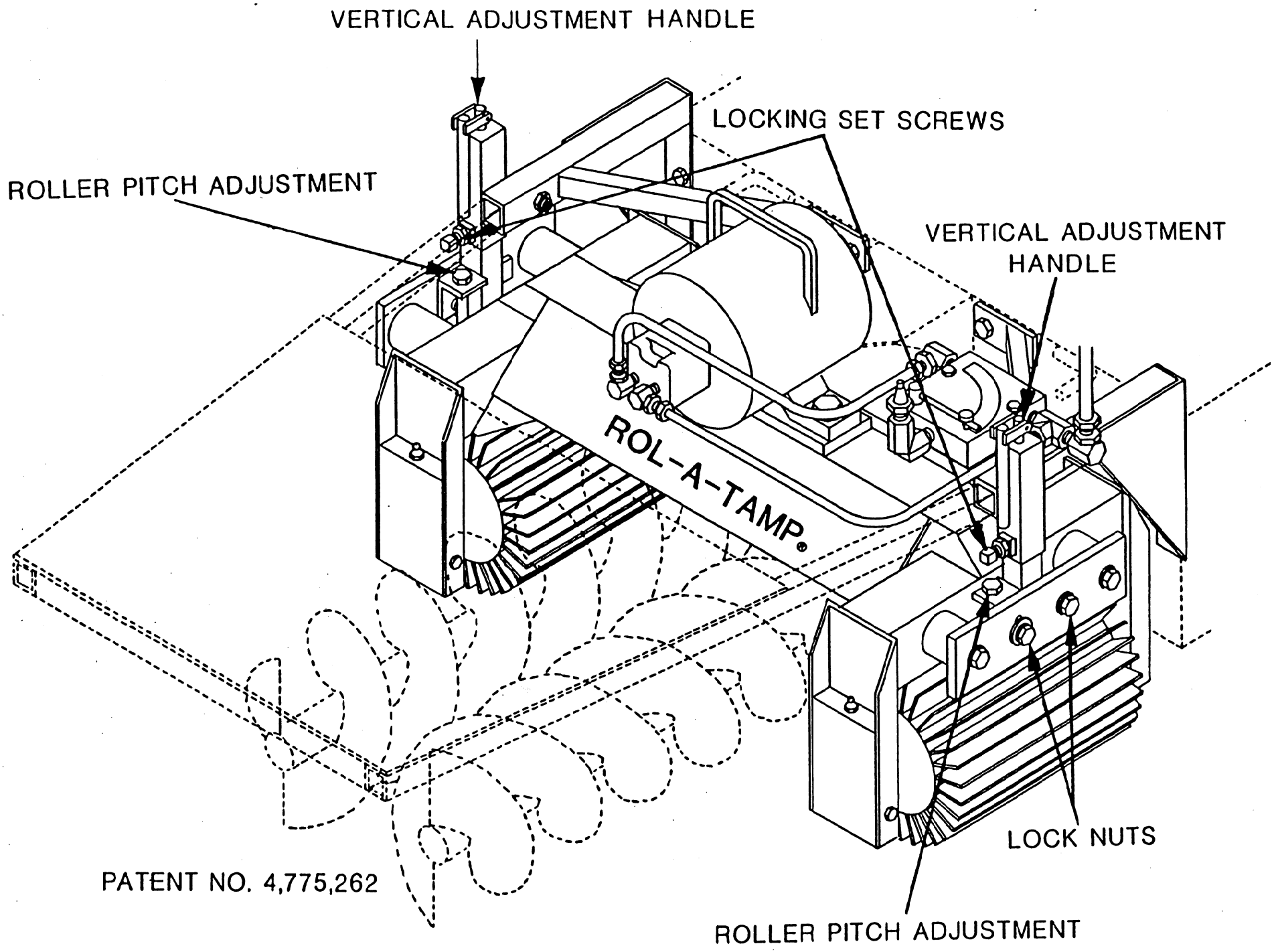
The BID-WELL Rol-A-Tamp finishing attachment provides a means of achieving a more uniform concrete surface with desired density. This facilitates sealing difficult to finish concrete. Because of harsh mix designs, low slump specifications, wind exposure causing abnormal surface drying and unforseen and unpredictable delays.

The Rol-A-Tamp which mounts from the finishing carriage, utilizes two free-wheeling finned rollers, 11" long - 7 1/2" O.D. with fins 1" long 3/16" thick. The finned rollers are positioned between the leveling augers and finishing rollers. The finned rollers are vertically adjustable from l/2" above concrete grade to l/8" of fin penetration below concrete grade. recommend 3/4" for Latex overlays

Vibration is provided to prevent concrete from sticking and/or building up on the roller fins. The vibration frequency is variable up to 5000 VPM.

The easy vertical adjustments of the RobA-Tamp makes possible quick "on the go" adjusting of the penetration of the fins.

A fin penetration of approximately l/8" will yield best results and the depth of penetration will vary according to concrete conditions.



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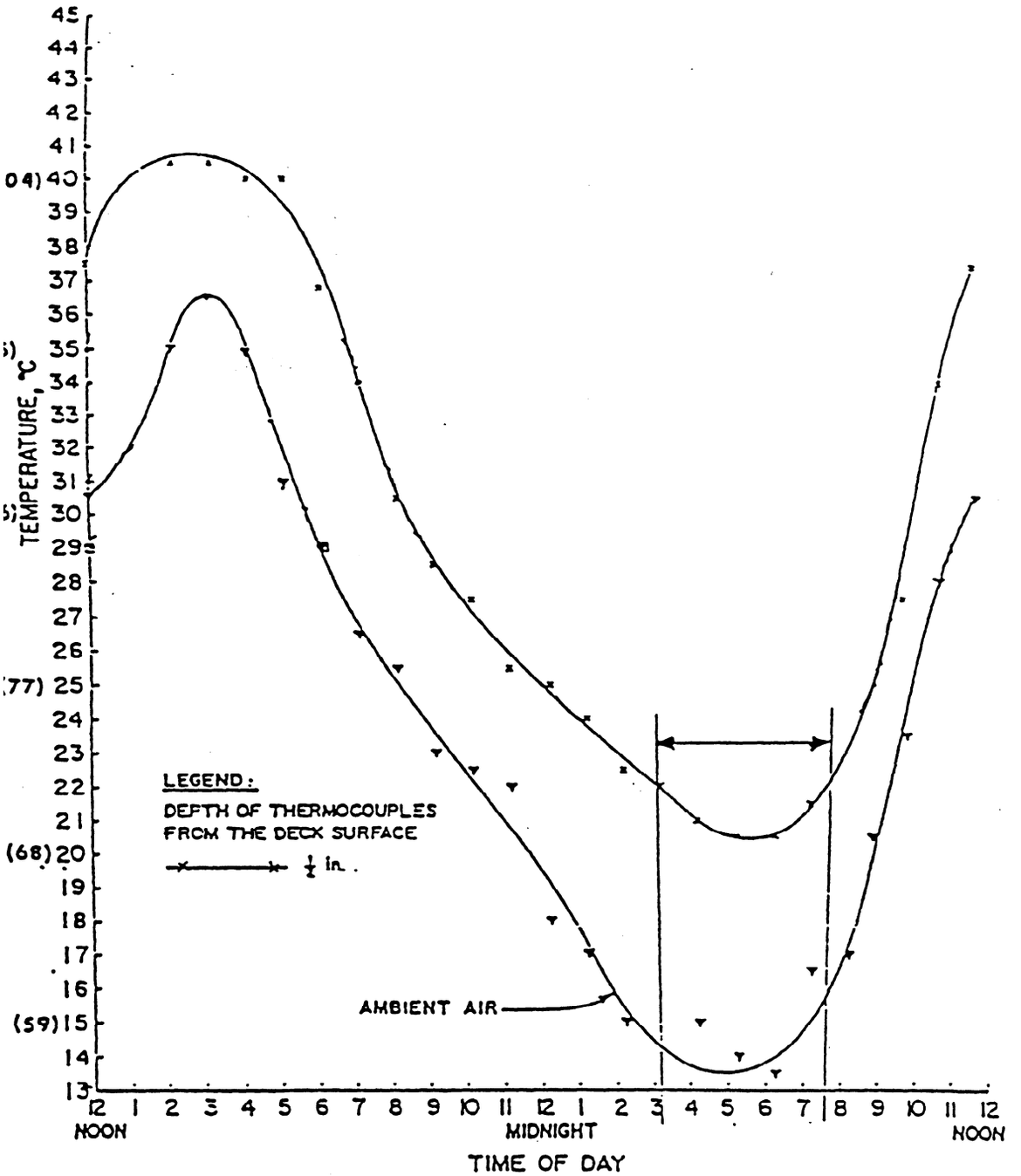


TYPICAL TEMPERATURE DISTRIBUTION IN

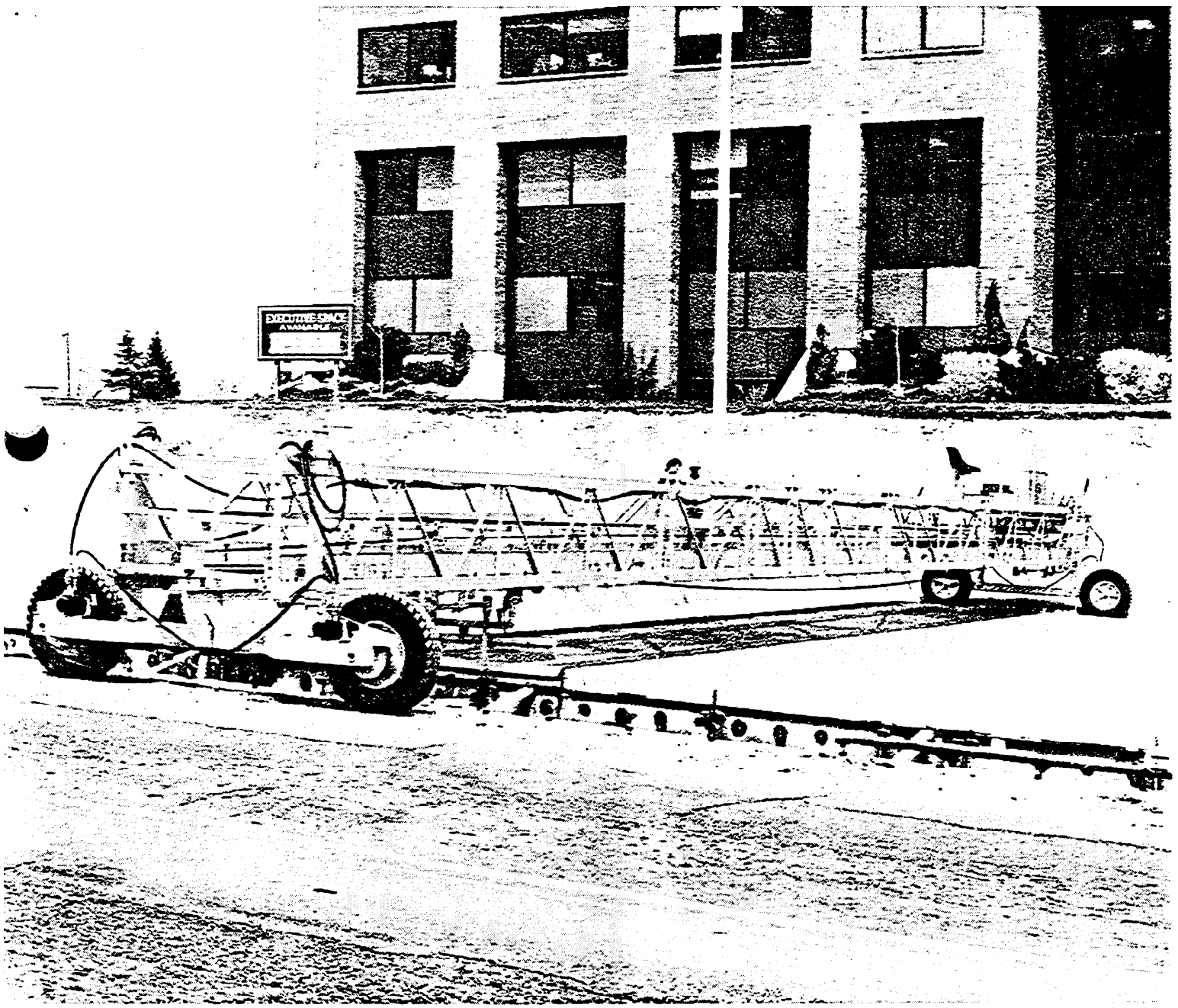
A THICK SLAB DECK

REF: ONTARIO MINISTRY OF TRANSPORTATION

CMI BID-WELL

TC3000A and TC3000M

TEXTURING-CURING MACHINE



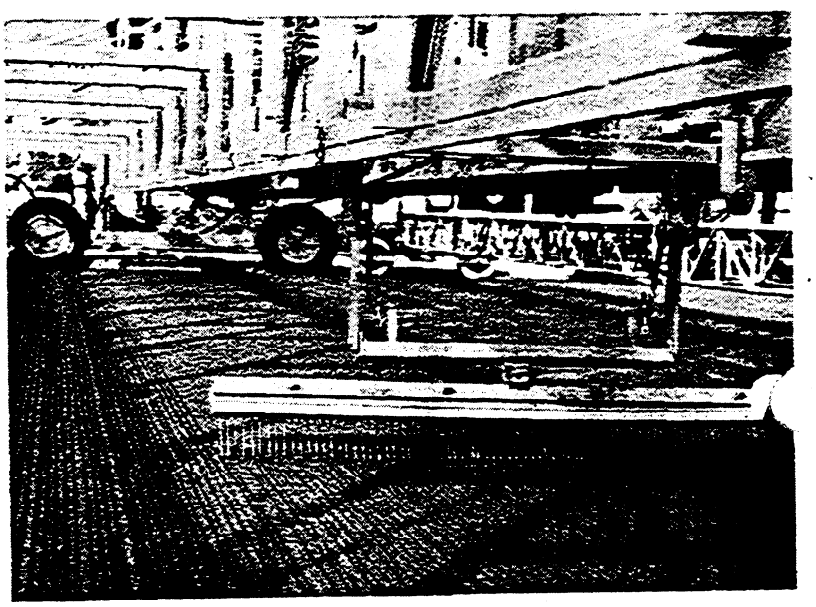
Look to the Leader!

TC-3000M textures concrete as the rake passes in each direction.

THE RIGHT EQUIPMENT FOR THE JOB TO MAKE YOU THE MOST PROFIT

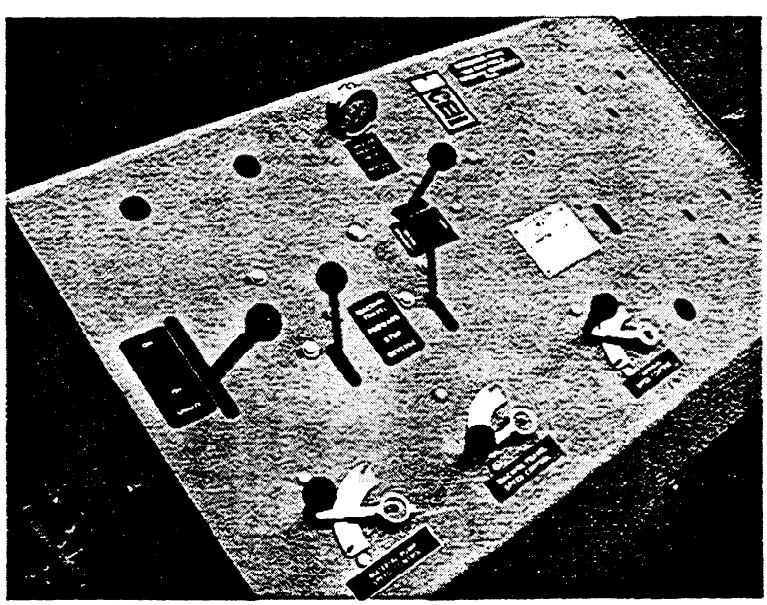
Bid-Well's versatile Texturing-Curing Machines (TC-3000A and TC-3000M) are fully adjustable to accommodate any width up to 50 feet. The 5 foot steel tine texturing rake engages the concrete as it passes in each direction and can be purchased to meet any specification. The curing system is a hydraulically driven pressure system and will handle any type of spray.

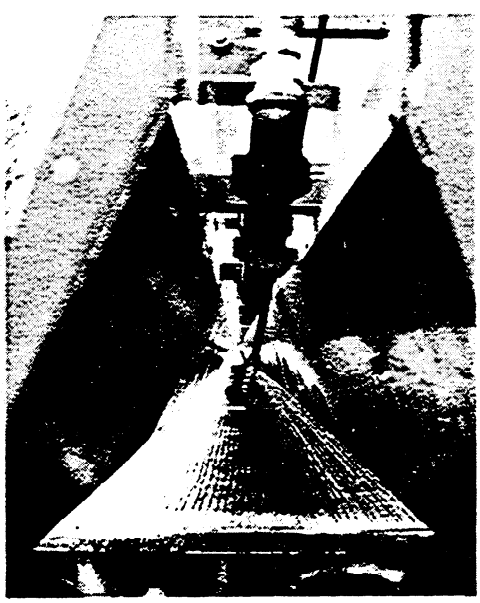
The TC-3000A utilizes two hydraulic sensors to sense a stringline for automatic steering.



TC-3000M applies curing material to city street (above). Spray nozzles inside windshield (below right).

(Right) Easy to operate control console showing blanks for optional accessories.





BID-WELL TC-3000 TEXTURING-CURING MACHINE

MACHINE FRAME

All welded structural steel tubing construction is used for strength with minimum weight. Truss sections are pm connected for fast set-up time and crown ability. Insert sections to extend machine length are available in 12 (3.7m). 6 (1.8m) and 3 (0.9m) foot lengths.

ENGINE

Air cooled. 4-cycle gasoline powered, twin cylinder opposed. 20 HP (14.9 kw) with 12 volt starter and alternator. 19 HP (14.1 kw) 2-cylinder 4-stroke Hatz Diesel is available at extra cost.

MACHINE TRAVEL

Positive Hydraulic 4-wheel drive. Manual controls give-forward. reverse and self braking action. Variable speed from 0 to 200 FPM (0 to 60 mPm). 7.00 x 15 traction-tread tires.

MANUAL STEERING, TC3000M

Manual Steering is accomplished by the operator from the control panel. The machine travels straight forward and the operator makes skid steering corrections by slightly "feathering" the appropriate directional valve while the machine is moving.

AUTOMATIC STEERING, TC3000A

The machine operator may select automatic (forward and reverse) steering from the control panel. Two Hydraulic Steering Sensors are used to sense the stringline. one for forward motion and one for reverse motion. When desirable, Manual Steering can be accomplished from the operators control panel.

TEXTURING

The texturing carnage travel speed is variable up to 90 FPM (30 mPm). The 5 foot (1.5m) long texturing comb is raised and lowered at the end of each texturing pass. The texturing comb may be ordered with tines spaced to meet the job specification requirements.

SPRAYING SYSTEM

A continuous spray bar and windshield run the length of the machine. Adjustable Position Nozzle drops are located at each end for spraying the edges of the concrete slab. Spray Nozzles are spaced at 18 inches (45.7cm) on the spray bar for double spray coverage with a single spray.

FILTRATION

A 2 inch (5.1cm). 20 mesh. wye suction strainer strains the material entering the pump. A 1 1/2 inch (3.2cm). 40 mesh wye strainer strains the material entering the spray boom and each nozzle has a 50 mesh screen to filter the material entering the nozzle.

NOZZLES

Stainless steel nozzle tips flow approximately 0.3 gallons (1.1L) per minute at 40 PSI (2.7 BAR). Each nozzle IS equipped with a diaphram check to prevent drip. Nozzle design provides instant access to clean individual nozzle tips and screens. Selective nozzles may be quickly "plugged" for con. figuratlon changes.

SPRAY TANK

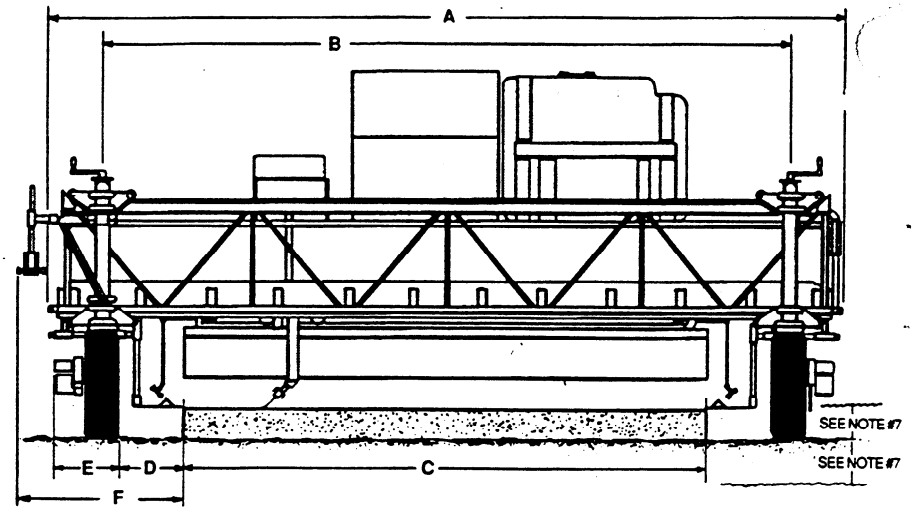
150 gallon (567L) capacity tank has built-in mixing jets for best mixing. The hydraulically driven Roper pump continuously circulates curing material through mixing jets to keep the material ready to spray. Spray tank is filled utilizing spray system and 25 foot long suction hose to transfer from barrels.

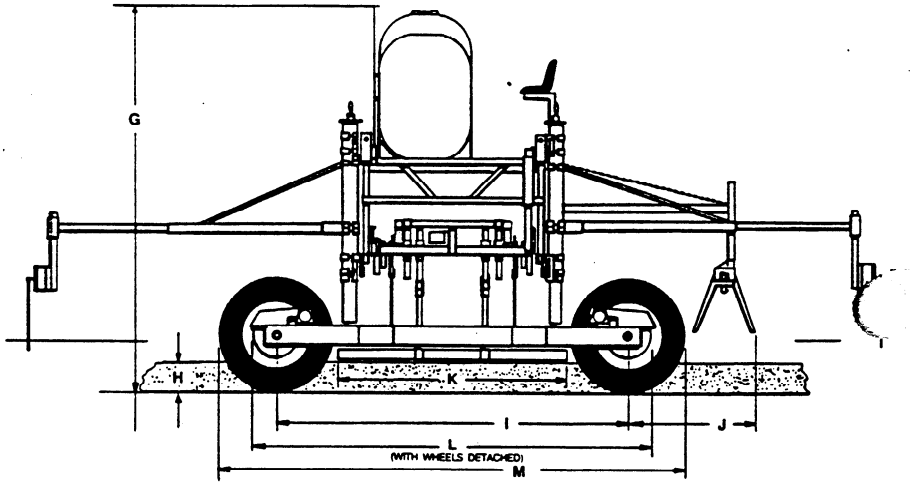
SPRAY SYSTEM CLEANUP

System may be flushed with cleaning solvent or water utilizing system pump without emptying curing material from tank.

TOWING

Trailer Dolly and Towing Tongue are available for the machine.





DIMENSION KEY (9)

All dimensions are for machine shown; 18' (553m) main truss section over an 8" thick concrete slab.

KEY LETTER	FOOTNOTE KEY	DESCRIPTION		DIMENSION FOOT	M
A	(1)	Overall Truss Sect Ion Width		18.16'	5.53m
B	(2)	Leg Span Maximum		15.67'	4.78m
C		Concrete Slab Width		12'	3.66m
D	(2)	Concrete Slab to Inside of Tire		17"	43.18m
E		Tire to Outside of Drive Motor		19¼"	44.45cm
F	(3)	Slab to Stringline	MAX	84"	213.36cm
			MIN	42"	106.68cm
G	(4)	Overall Height		8.33'	2.54m
H	(4)	Concrete Slab Thickness		8"	20.32cm
I		Wheel Base		7.73.	2.36m
J		Distance from Wheel Center to Spray Boom		2.75'	0.84m
K		Comb length		5'	1.52m
L	(6.8)	Front-to Rear Length		8.98'	2.73m
M	(6.8)	Front-to-Rear Length with Wheels		10.23'	3.12m

FOOTNOTE

(1) Machine may be lengthened by adding 3.6 and 12 foot (0.9. 1.8 and 3.6m) frame sect ions.

(2) Each machine leg moves on own dolly to accommodate different width pours. Tire to slab distance can be adjusted to suit job requirements.

(3) Sensor mounts are adjustable to accommodate different string height and distances.

(4) The legs can be vertically adjusted for slab depths up to 24 inches.

(5) Spray boom is quickly adjustable for different spray heights to optimize spray coverage.

(6) To facilitate transporting the machine, the spray shield can be slid close to the machine.

(7) The machine wheels on either end can be vertically adjusted with the leg cranks to ride on a grade from 2 inches above the finished concrete to 24 inches below.

(8) The entire wheel assembly may easily be removed from both machine ends when necessary for overall width transportation restrictions.

(9) The machine shown is the Model TC3OOOA with the automatic steering system. All dimensions shown, except Dimension "F", will be the same for the Model TG3OOOM with the manual steering system.

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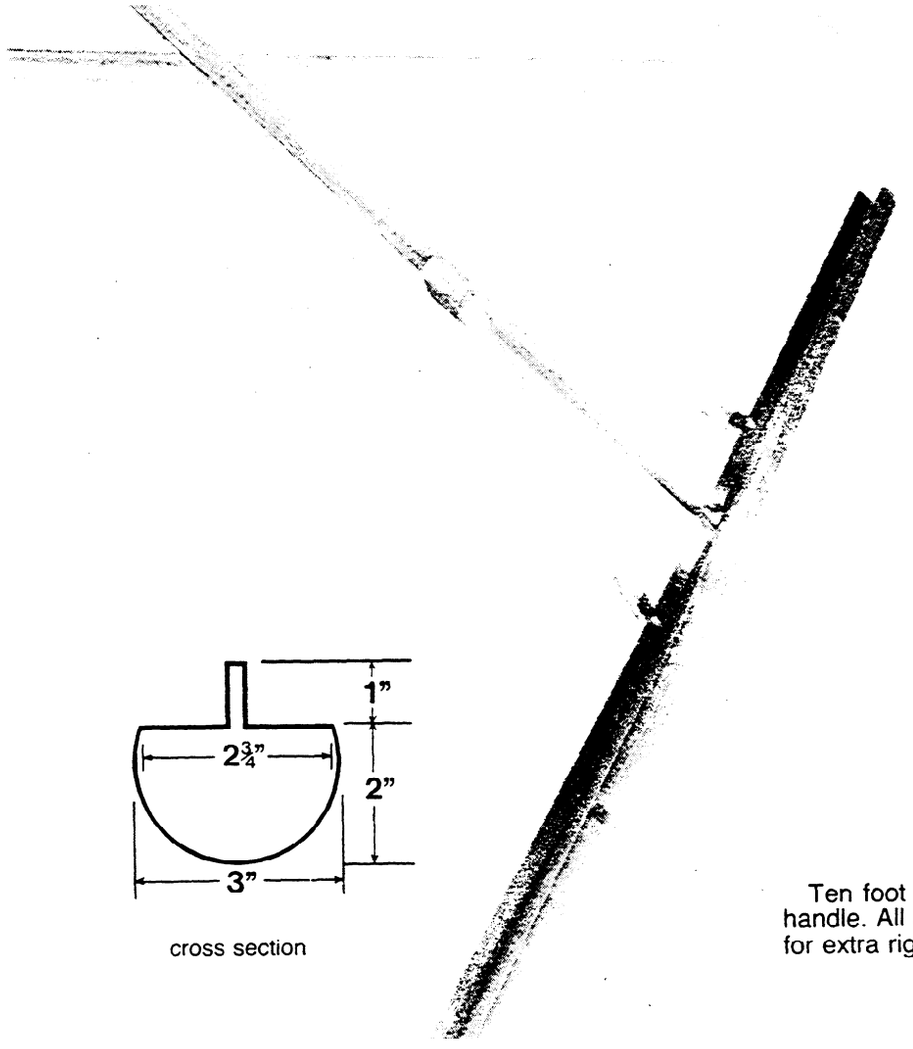
BID-WELL®

GROUT ROD STRAIGHT EDGE



cross section

Ten foot long straight edge with ten foot long handle. All aluminum. Half-round and rib backed for extra rigidity and light weight.

Write or call for complete information today -

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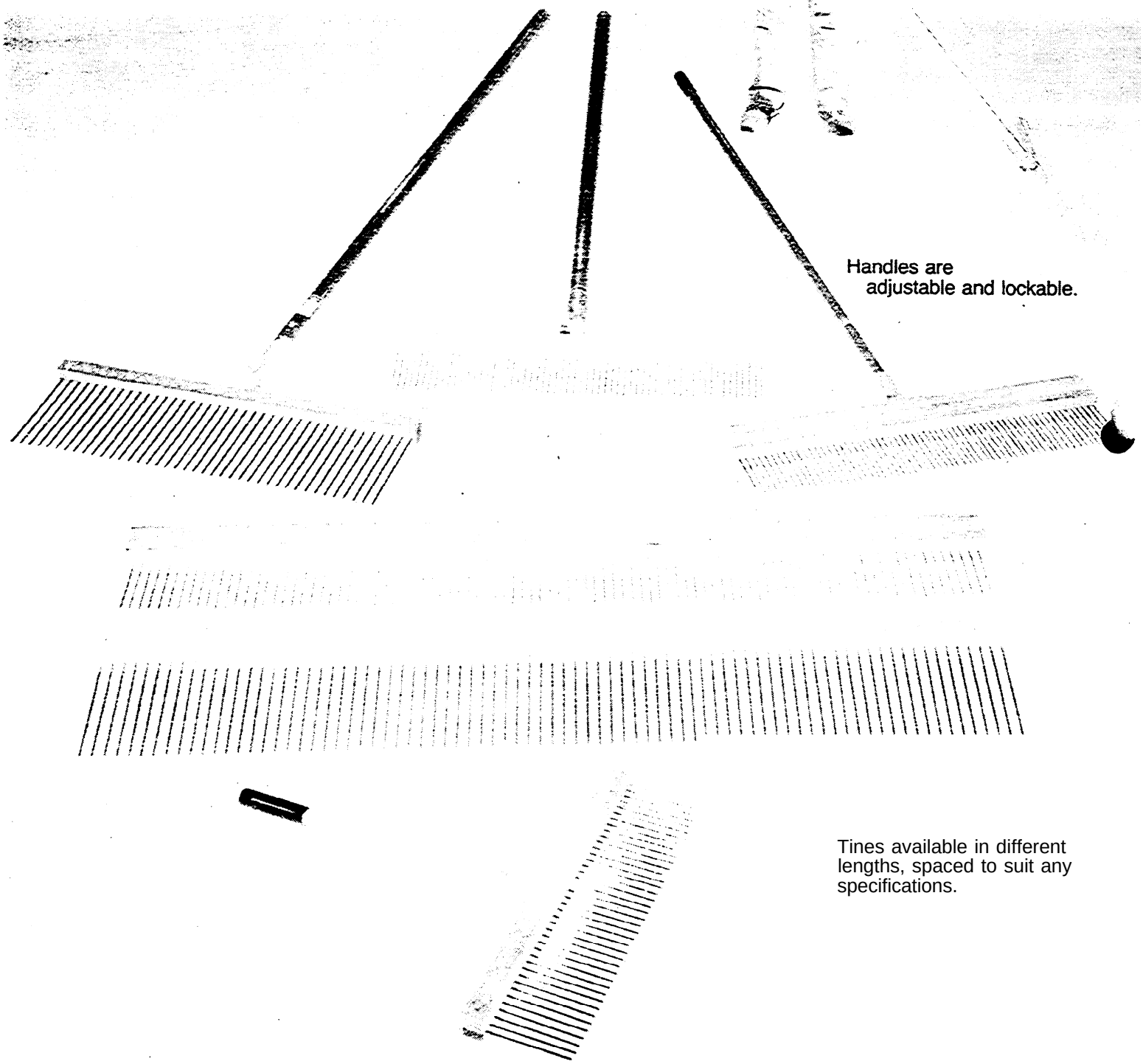
TEXTURING RAKE



Handles are adjustable and lockable.

Tines available in different lengths, spaced to suit any specifications.

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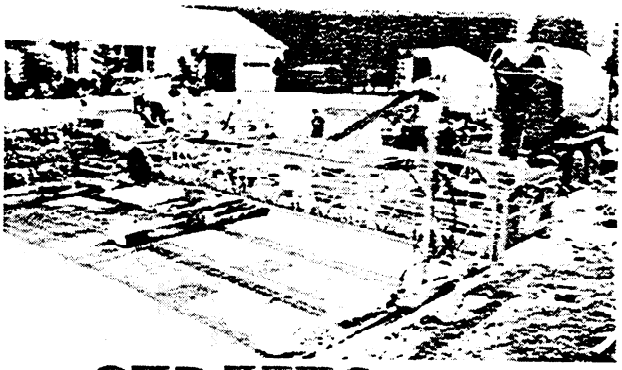
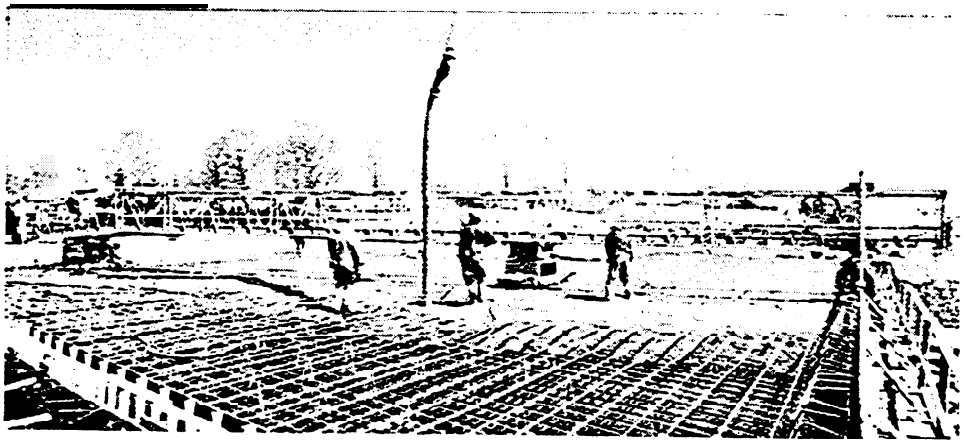
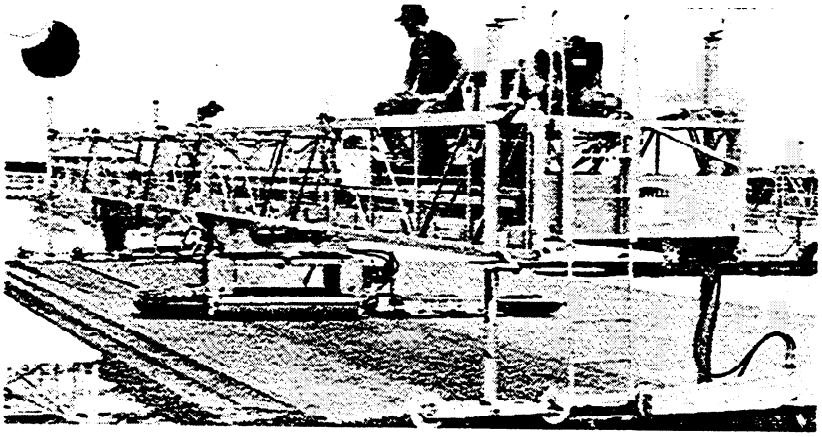
BID-WELL DOES THEM ALL!

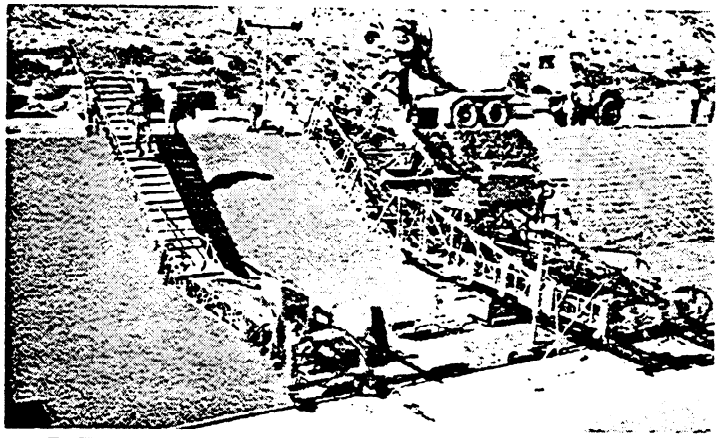


STREETS

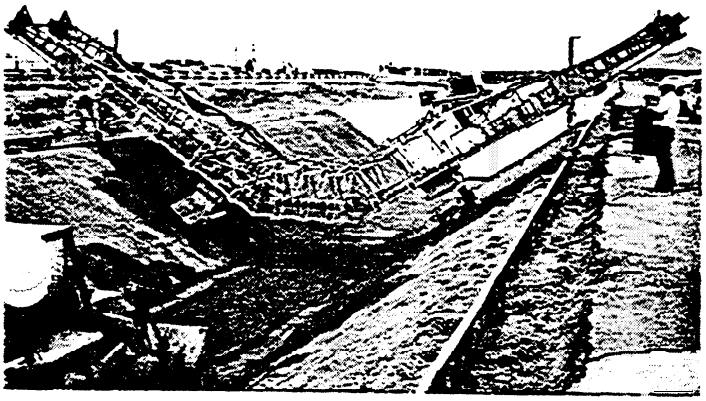


BRIDGES OVERLAYS





HIGHWAYS SLOPES



CANALS

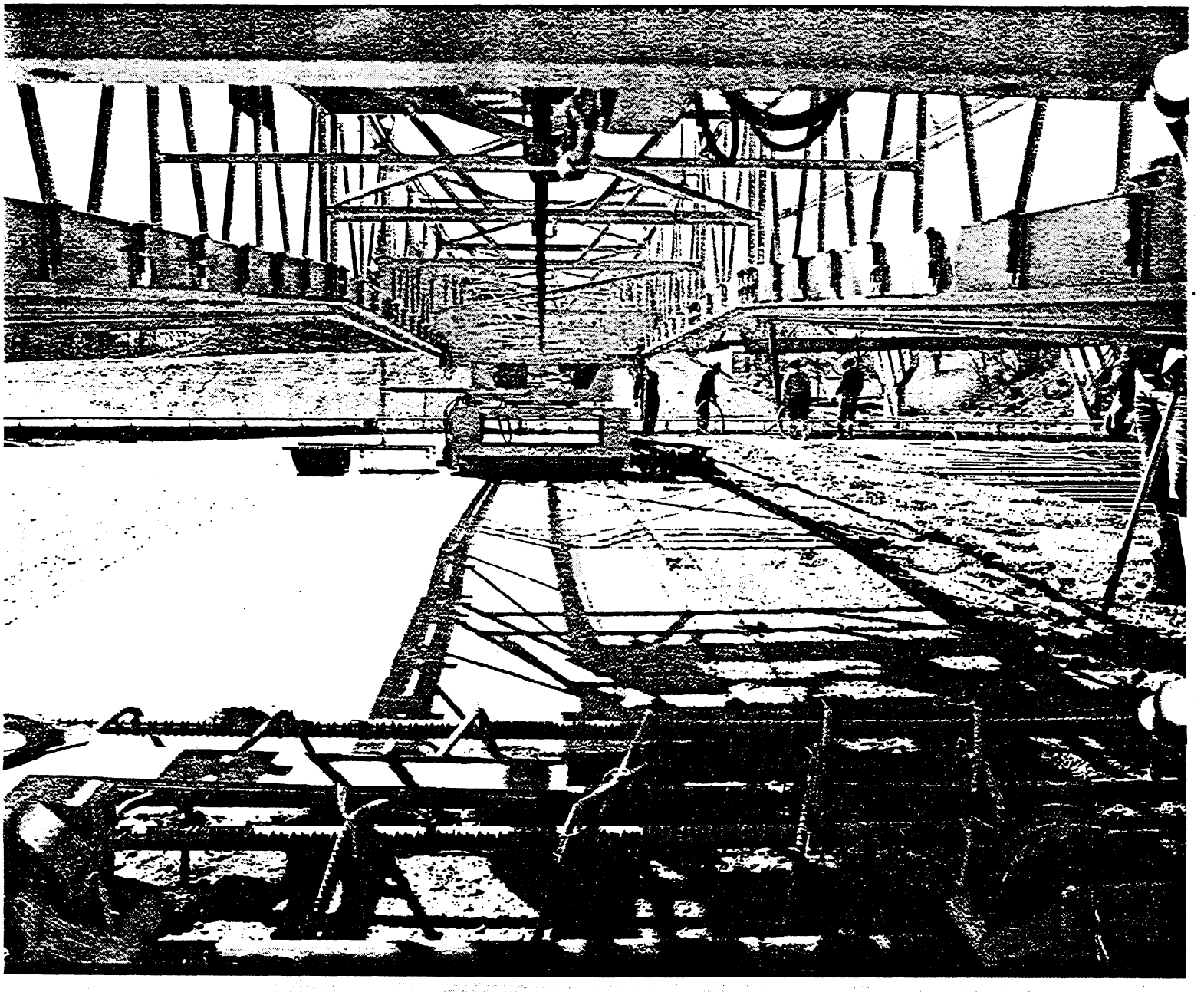
Talk about versatile. Bid-Well does all these concrete finishing jobs - and can trim subgrade as well!

Bid-Well's dual augers plow excess concrete forward on each pass, leaving exactly the proper amount of concrete for an excellent finish. Then double rollers four feet long and 8" in diameter reverse direction of rotation to finish concrete with every pass. Drag plates and burlap drags can complete the surface finishing in one operation.

The Bid-Well molds all crowns - flat, parabolic or inverted. It finishes tapered slabs of varying widths, adjusts to skews up to 45 degrees. finishes high or low slump concrete, finishes super elevations and slopes. It meets all specified tolerances.

Bid-Well has got what it takes for today's concrete finishing. You couldn't ask for more!

BID-WELL Canton, SD 57013
Telephone (605) 987-2603 Telex: (CMI International) 747167



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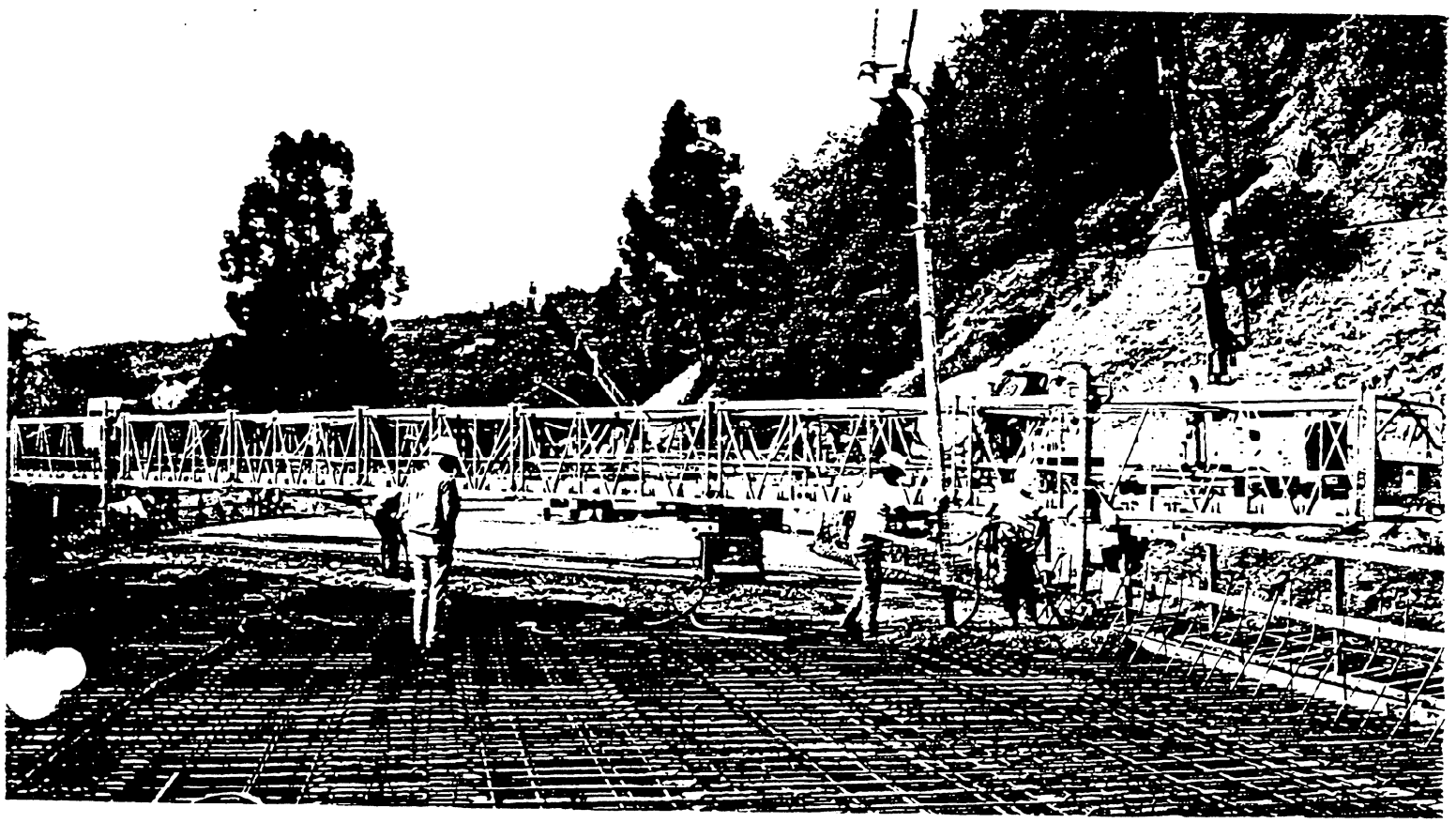
BR & 4800 PAVING SKEWED DECKS



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PRELIMINARY INFORMATION FOR A SKEWED DECK

In paving skewed decks it is essential to have all the job specific&ions and special details before determining what you need to set up your Bid-Well Roller Paver. To aid you there are four questions you will need to answer-

1) What is the skew angle measured perpendicular to center-line? (or 90 degrees to centerline)

2) What is the distance (Measured perpendicular to the center-line of the deck) between the pipe or screed rails?

3) Is the deck super elevated?

4) Is the deck crowned?

DETERMINING MACHINE LENGTH

To determine the length of the machine set at the required skew angle, use the simple equation below. In column (1) find the required skew angle. In column **(2)** multiply that figure by the number of feet from screed rail to screed rail (measured perpendicular to centerline). Add the answer from column (2) to the extra end length of the machine needed to span at that particular skew angle. The extra end length has to be added in order to allow the machine legs to be positioned correctly.

FOR BIDWELL MODEL BR AND **4800 SERIES MACHINES**

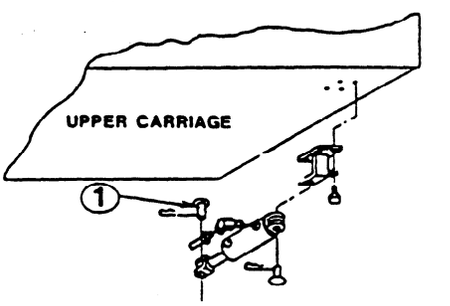
Total machine length required (in feet) = A+B

(1) Skew Angle in Degrees	(2) A Rail to Rail Length in Feet	(3) B Extra Machine End Length in Feet
15	1.04 x w	5 '
20	1.06 x W	5 l/2'
25	1.10 x w	6 l/2'
30	1.15xw	7'
35	1.22 X W	8 '
40	1.31 X W	9 '
45	1.41 X W	10 l/2'
50	1.56 X W	11 l/2'
55	1.74 X W	13 l/2.'

BASIC MACHINE INFORMATION

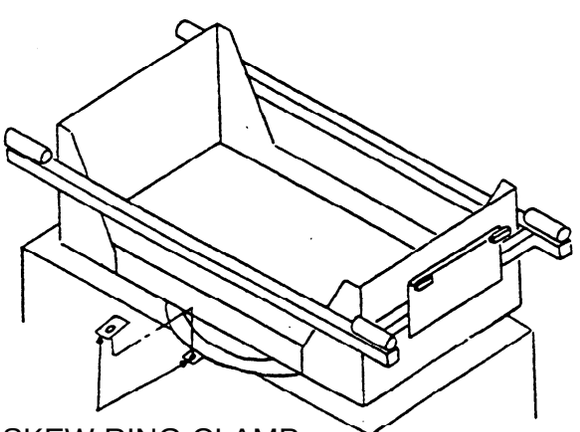
After the truss frame and carriage rail have been straightened according to a standard machine set up, the paving rollers, (which are mounted from a turntable and can be turned to match any machine skewed up to 55 degrees) are now ready to be turned so the paving rollers are parallel to the centerline of deck. Follow the steps below.

1) Mechanically disconnect the hydraulic skew cylinder, if the machine has one (refer to fig. 1) and tie it back out of the way.



REMOVE PIN # 1 **(FIGURE 1)**

2) Rotate the paving rollers so they are parallel to the center-line and lock in position using the skew ring clamps provided. with the machine (refer to fig. 2).

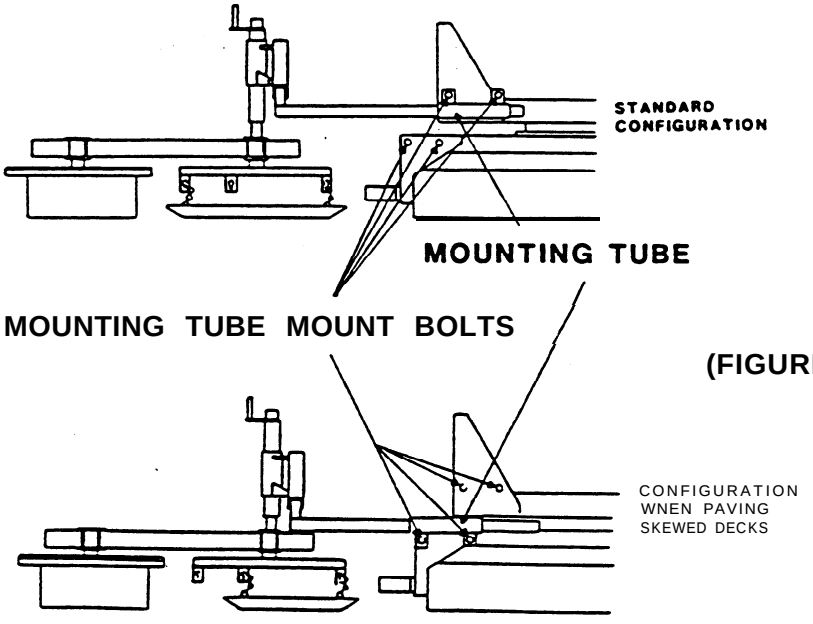


SKEW RING CLAMP **(FIGURE 2)**

CONTINUED....

3) The drag pan hanger system must be removed and remounted on the lower carriage (refer to fig. 3). Remove the bolts that hold the mount tubes on the upper carriage, replace the bolts. Remount the mount tubes to the lower carriage. (The bolts for mounting to the lower carriage are in place on the lower carriage frame).

DRAG PAN MOUNTING CONFIGURATIONS



(FIGURE 3)

4) The drag pan and astro grass or burlap drag H frames will need to be turned so that they are parallel to the machine truss frame. This allows the pan and astro grass or burlap drag to follow the skew angle as the carriage travels across the deck or slab.

5) At this point the paving rollers need to be stringlined to the carriage rail, making the paving rollers paralled to the carriage rail. Being sure to run the stringline across the top of the carriage rail adjacent or parallel to the paving rollers (refer to Roller Paver Set Up Instructions).

FLAT DECKS / SUPERELEVATIONS (NO CROWNS)

When paving flat skewed bridge decks, the machine may either be placed on the skew or perpendicular to the centerline and paving as one wou1d a standard bridge deck, placing the concrete on the skew angle of the deck. No special attachments are required.

If the deck is superelevated, the machine must be placed so paving will be from the low side of the deck to the high side of the deck, noting also that the machine paves from the leading end (must be the low side of the deck) of the machine to the trailing end of the machine (high side of the deck). (Page 5 fig. 4). The roller rotation should be set to rotate in the same direction (paving up hill) and not reversing roller rotation at the end of each carriage pass: This eliminates pulling or moving the concrete from the high side of the deck to the lower side.

CROWNED DECKS

INFORMATION WITH OR WITHOUT SUPERELEVATION....

Review the project specifications and requirements, and determine the skew angle that the machine will be placed on the deck.

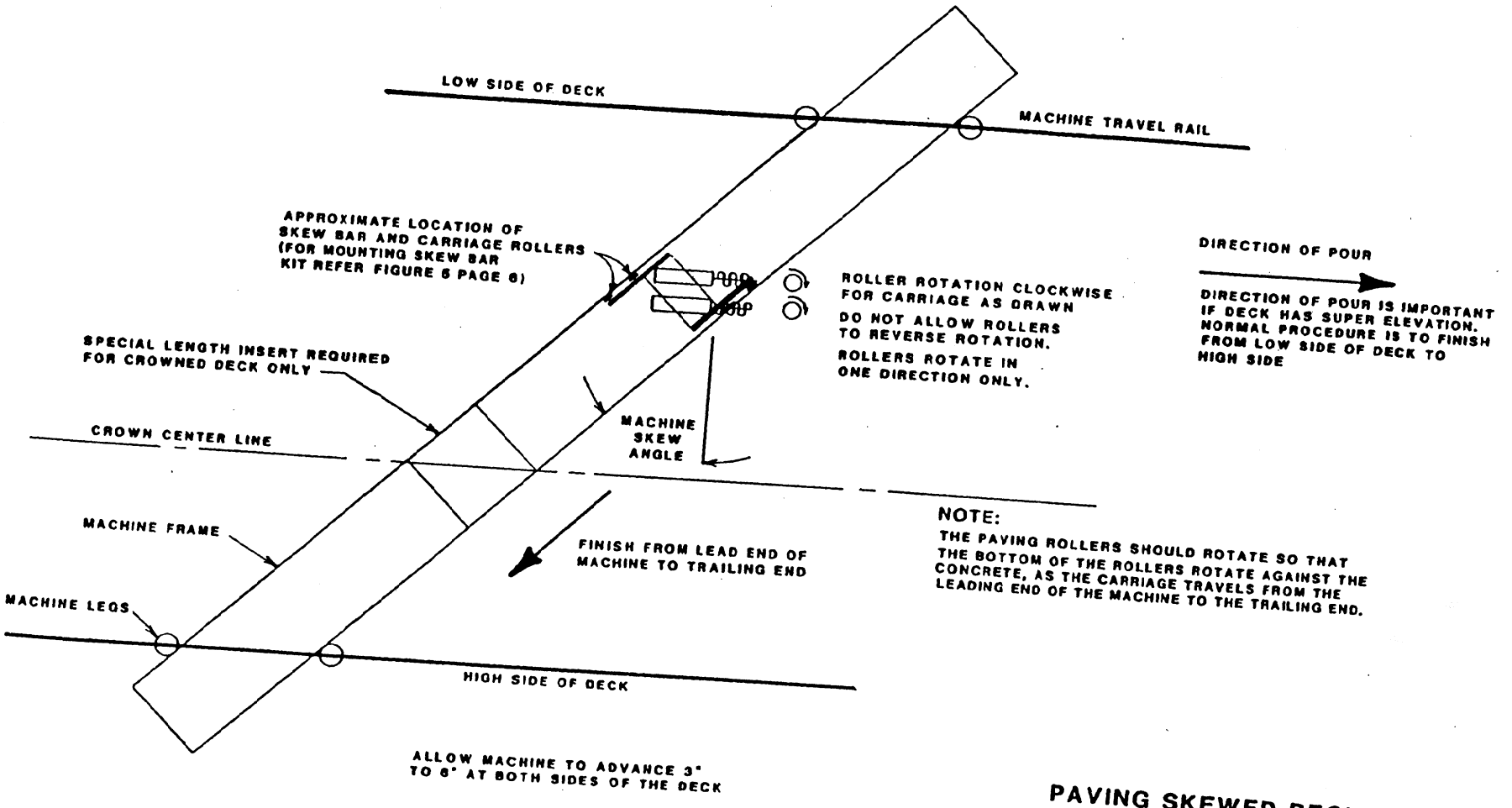
When determining machine lengths for Skewed Decks with a crown, remember all lengths start from the crown line. One side may require different length inserts or sections than the other. (Page 5 fig. 4) This information will also help in determining how the machine is to be placed onto the deck and direction of pour.

If the crowned deck requires a special length insert to be installed and the use of a Skew Bar Kit, the chart below gives the recommended special insert lengths for crowned decks.

BID-WELL RECOMMENDATION

SPECIFICATION SKEW ANGLE (DEGREES)	ACTUAL SKEW ANGLE (DEGREES)	SPECIAL INSERT LENGTH (FEET)
15 20	15	1 l/2'
25	25	3'
30 35	35	4'
40 45	45	6'
50	50	7'
55	53	8'

CONTINUED ON PAGE 6....



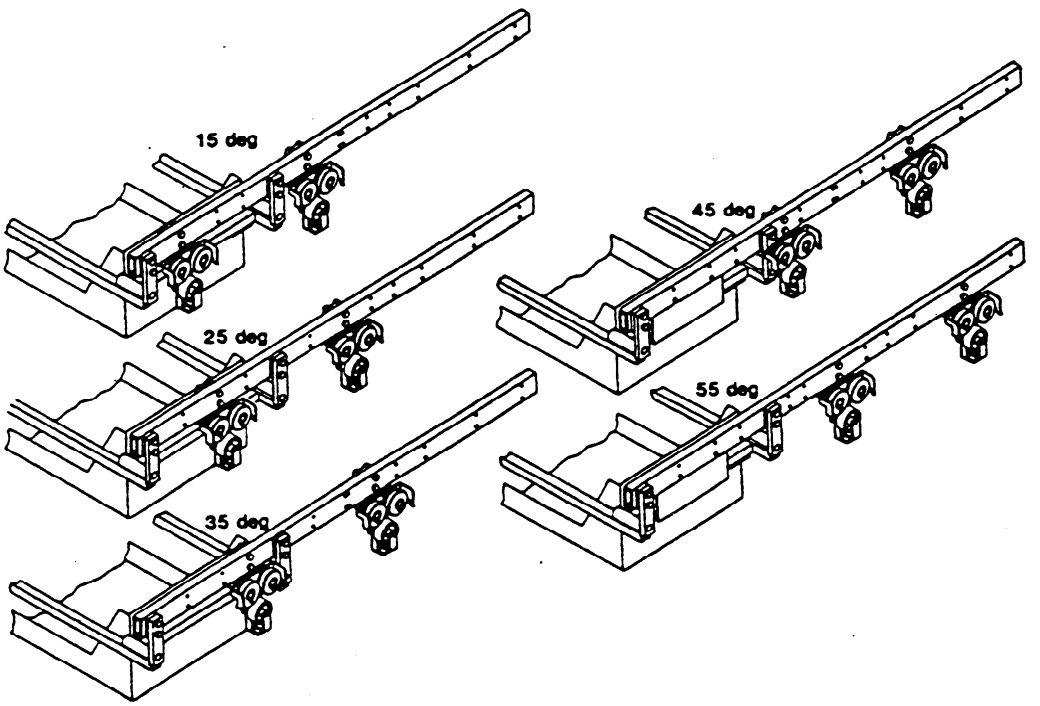
PAVING SKEWED DECKS

(FIGURE 4)

INFORMATION FOR CROWNED DECKS CONTINUED....

The machine frame and carriage rail should be crowned directly above the crown line on opposite corners of the inserts. In some applications and specific skew angles, it may require a special length insert which may be obtained from the factory, (Page 5 fig. 4) NOTE: WHEN PLACING A CROWN INTO THE MACHINE FRAME, REMEMBER TO REMOVE THE BOLTS IN THE DIAGONAL ANGLE BRACES IN THE SECTION BEING CROWNED.

When paving skewed decks with a crown either superelevated or not, Bid-Well recommends the use of a Skew Bar Kit, that attaches to the Upper Carriage. This allows the carriage rollers to become off-set 30 as the carriage passes through the crown; the paving rollers pass over the crown line parallel to the crown line. The Skew Bar Kit comes predrilled for skew angles 15 degrees through 55 degree increments. (Page 6 fig. 5). If a Skew Bar Kit is required and field installed, it may be advantageous to remove the carriage, install the Skew Bar Kit, and reinstall the carriage when the machine frame is split to install additional machine inserts.



(FIGURE 5)

SKEW BAR KIT -

INSTALLATION INSTRUCTIONS....

1. Remove the carriage assembly from the machine and block up the carriage so that the carriage weight does not rest on the paving rollers.

2. Remove or deactivate the carriage skew cylinder, if one is installed on the carriage.+ The skew cylinder is optional equipment on some machine models.

3. Remove the carriage wheel pivot assemblies from the carriage hanger frame (Item A) and retain for reinstallation. (Figure 6, Page 7).

4. If the skew angle is less than 45 degrees, 'it will be necessary to remove the chain tightener plates from the side of the carriage hanger frame. See (Item"B") (Figure 6, Page 7), chain tightener plates for future use, should the Skew Bar Kit ever be removed,

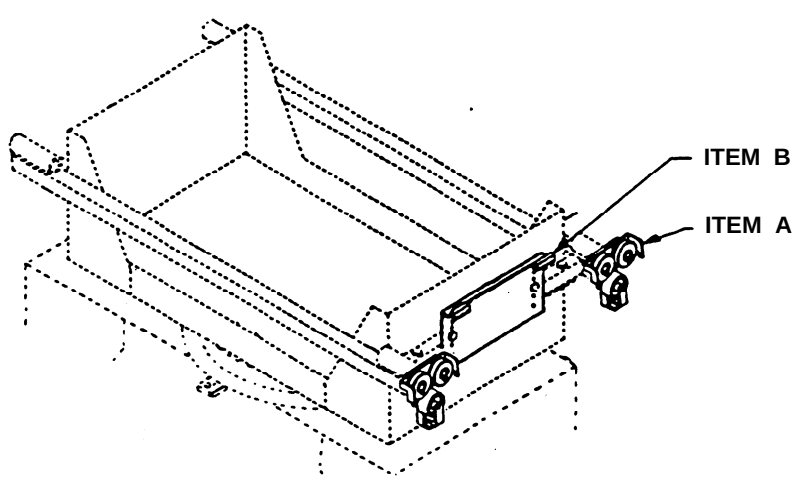
5. Install the tube mount brackets into the Upper Carriage Frame and mount the Skew Bar Tubes at the locations marked "Base", as shown on (Figure 7, Page 8).

6. Install the carriage wheel mounts onto the Skew Bars at the bolt holes that match the angle determined for this project. (Figure 5, Page 6).

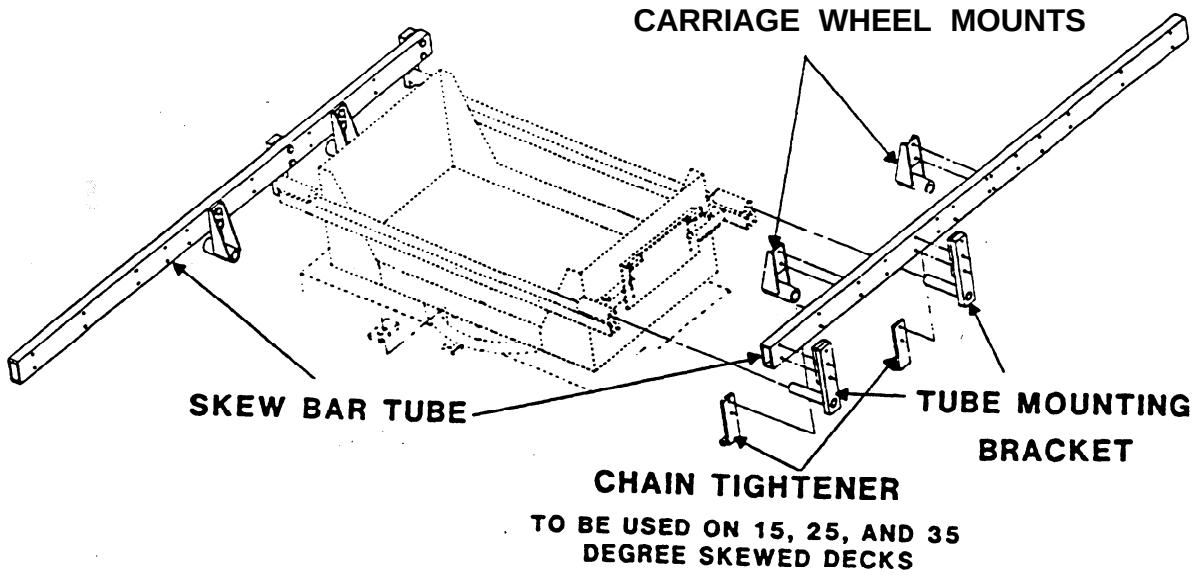
7. Install the carriage wheel pivot assemblies that were removed in step 3, onto the wheel mounts on the skew bars,

8. Install the complete carriage assembly, with Skew Bar Kit, into the machine frame. If the carriage assembly, with Skew Bar Kit, is to be installed from the end of the machine, it will be necessary to loosen and pivot up; or remove the machine idler end frame panel.

NOTE: When ordering parts, have machine model and serial number available.



(FIGURE 6)



(FIGURE 7)

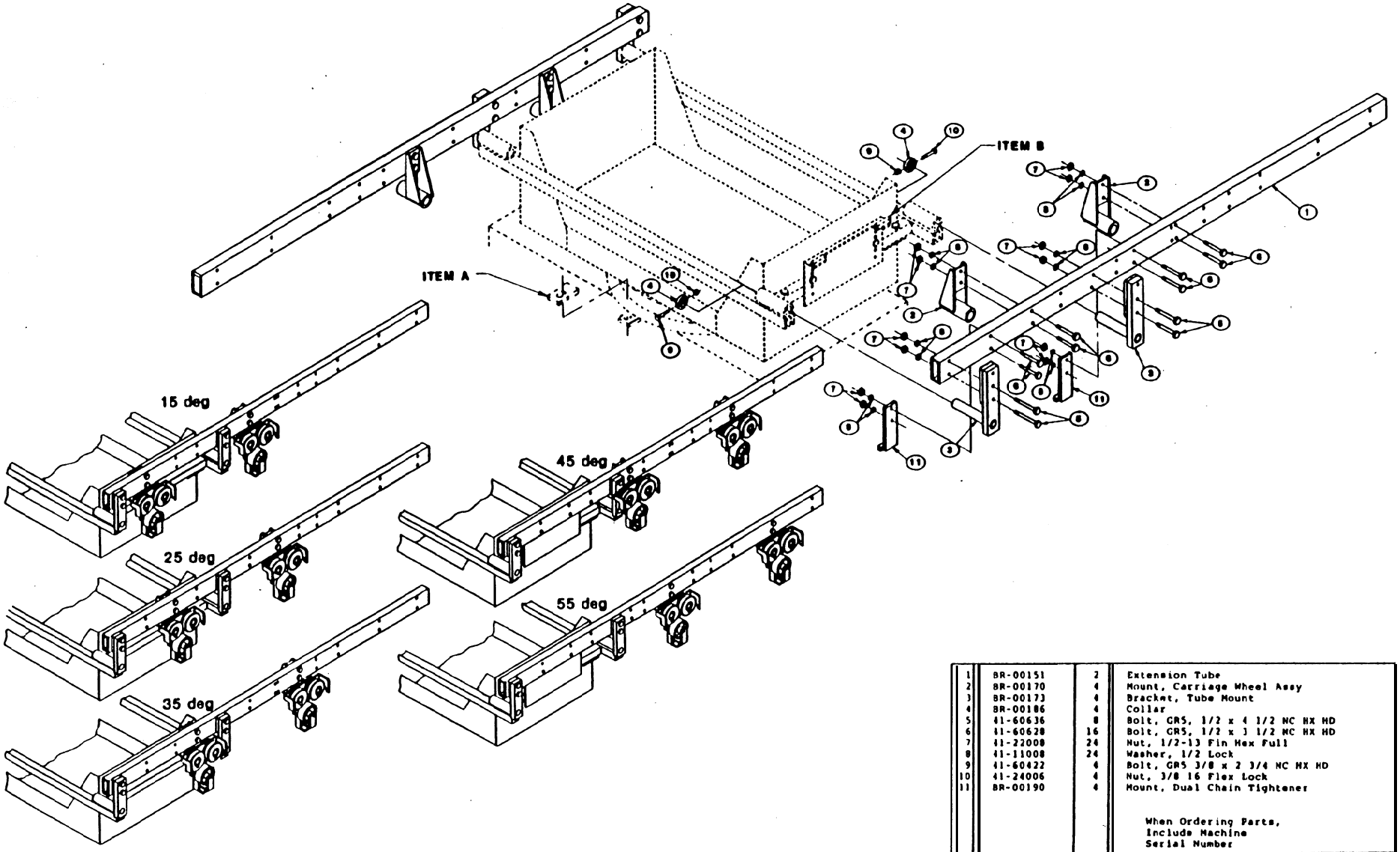
MACHINE OPERATION

The paving roller(s) must always turn in only one direction, when paving skewed decks. See (Page 5, fig. 4) for the correct direction of rotation for the finishing rollers). The rotation of the rollers should be set so that they finish the concrete only when the carriage travels from the leading end of the machine to the trailing end, Do not allow rollers to reverse rotation.

After the pour has started and the machine has moved out from the end bulkhead or has passed over the bulkhead' the full length of the paving rollers, raise the back of the machine l/8" by turning the back leg cranks l/2 turn counter clockwise. This will keep the rear of the paving rollers from digging in and leaving a small ridge of concrete.

It may be necessary to readjust the augers up or down to obtain or reduce the roll of concrete (optimum is golf ball size in diameter at the front of the paving rollers). As the machine progresses into the pour and clears the bulkhead or end dam, attach the drag pan and astro grass or burlap drag.

When paving concrete going up hill, the back or rear of the machine should be raised slightly more than l/8". When paving down hill, the rear of the rollers should be lowered by using the rear leg cranks so there is nearly total contact of the paving rollers onto the slab or deck surface. The optimum roller setting is to have maximum surface contact, but not to leave a ridge or line of concrete coming off the rear of the paving rollers.



1	BR-00151	2	Extension Tube
2	BR-00170	4	Mount, Carriage Wheel Assy
3	BR-00173	4	Bracket, Tube Mount
4	BR-00186	4	Collar
5	41-60636	8	Bolt, GR5, 1/2 x 4 1/2 NC HX HD
6	41-60628	16	Bolt, GR5, 1/2 x 1 1/2 NC HX HD
7	41-22008	24	Nut, 1/2-13 Fin Hex Full
8	41-11008	24	Washer, 1/2 Lock
9	41-60422	4	Bolt, GR5 3/8 x 2 3/4 NC HX HD
10	41-24006	4	Nut, 3/8 16 Flex Lock
11	BR-00190	4	Mount, Dual Chain Tightener

When Ordering Parts,
Include Machine
Serial Number

KEY	PART NO	QTY	DESCRIPTION

BID-WELL CORPORATION
CANTON, SO DAK. 57013

DRAWN MLH	DATE 9/87	TITLE **SKEW BAR KIT**	
REVISED			
APP'D		KLUST NO	SHEET / PAGE NO

BIDWELL®

MACHINE LOAD WEIGHTS FOR BR & 4800 SERIES

BIDWELL P.0. BOX 97 CANTON, SOUTH DAKOTA 57013 AREA CODE 605 PHONE 987-2603 TELEX 295001 FAX 605987-2605

5.6 MACHINE WEIGHTS

5.6.1 DEAD LOADS FOR 4800 AND BR MACHINES

5.6.1.1 BASIC MACHINE WEIGHTS

Table 1 lists the weights of basic 4800 & BR Series Bid-Well Roller Finishers, as assembled at the factory from various length-insert sections. The weights in Table 1 do not include-the weight of the carriage or any accessories.

TABLE 1

BASIC MACHINE CONFIGURATION	WEIGHT
2-12 Foot Sections.	4304 lbs
2-12 Foot & 2-6 Foot Sections	5468 lbs
3 -- 12 Foot Sections	5180 lbs
2 -15 Foot Sections	4472 lbs
2 -45 Foot & 1 -6 Foot Sections	5O54 lbs
2 -18 Foot Sections	5000 lbs

The basic weight of your machine, Model _____, Serial Number _____ , is _____ lbs. as assembled at the factor;. Insert this weight into the total weight column on line 1, page 5-9. Divide the total weight by 8 (the number of machine wheels), to obtain the weight per wheel on the Idler End and the power Unit End of the machine.

5.6.1.2 MACHINE INSERT SECTION WEIGHTS

'Table 2 lists the weights of the various lengths of machine insert sections, complete with braces, carriage travel chain, and hydraulic hose.

TABLE 2

LENGTH OF SECTION	WITH LEG RAIL	WITHOUT LEG RAIL
3 Foot	381 lbs	360 lbs
6 Foot	582 lbs	540 1bs
12 Foot	876 lbs	792 lbs
15 Foot	960 lbs	840 lbs
18 Foot	1224 lbs	1080 lbs

Determine the number of each length and type of insert sections that are going to be added to the basic machine. Add the weights of those sections, to obtain the total weight of extra inserts. Place this weight into the total weight column on line 2, page 5-9. Divide the total weight by 8. to obtain the weight per wheel on the Idler End and the Power Unit End of the machine.

5.6.1.3 WEIGHT OF MACHINE ACCESSORIES

Table 3 lists the ADDITIONAL weights that various machine accessories add to the weight of the basic machine. These weight figures take into consideration, any basic machine parts that the accessory replaced.

TABLE 3

MACHINE ACCESSORY		ADDITIONAL WEIGHT
4″ Plate Leg Mounts	(Set of 4)	224 lbs
4″ Swingout legs (1 end)	(Set of 2)	180 lbs
4″ Swingout Legs (2 ends)	(Set of 4)	360 lbs
6" Plate Leg Mounts 8 Legs	(Set of 4)	348 lbs
6″ Swingout Legs (1 end)	(Set of 2)	240 lbs
6″ Swingout Legs (2 ends)	(Set of 4)	480 lbs
Powered Crown Adjuster		330 lbs
Manual Crown Adjuster		66 lbs
Power Widening. (1 end of machine)		170 lbs
Power Widening (2 ends of machine)		340 lbs
Power Leg Screws	(Set of 4)	160 lbs
Towing Tongue		105 lbs
23 HP Engine		50 1bs

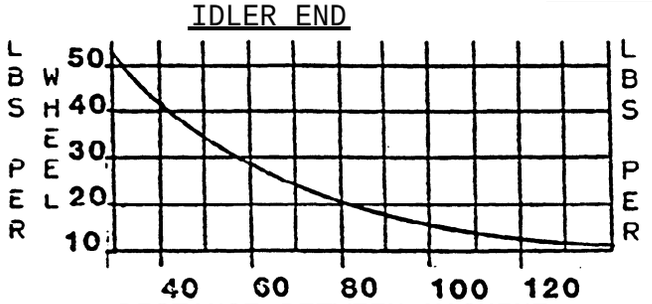
Determine which accessories are going to be installed on the basic machine. Add the additional weights of those accessories, to obtain the total additional weight of accessories. Place this weight into the total weight column on line 3, page 5-9. Divide the total weight by 8, to obtain the weight per wheel on the Idler End and the Power Unit End of the machine.

5.6.1.4 WEIGHT OF POWER-FOLD DOLLY

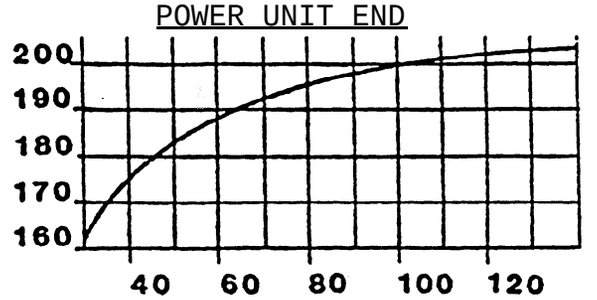
If your machine is NOT equipped with a Power-Fold Dolly, disregard table 4. Table 4 is composed of two graphs, showing the additional weight contributed by the Power-**Fold** Dolly. for the Idler End of the machine and the Power Unit End of the machine. Before using Table 4. determine the distance between the machine travel rails. in **feet.**

TABLE 4

IDLER END



POWER UNIT END



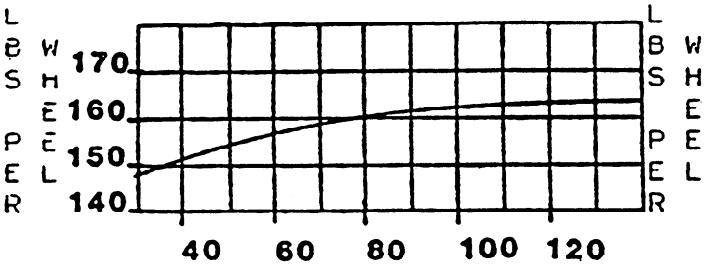
Enter the total weight of the Power Fold Dolly, 865 lbs. into the total weight column of line 4. page 5-9. find the wheel loads for the Idler End and Power Unit End from the graphs, and enter those loads into the proper columns of line 4, page 5-9.

5.6- 1.5 WEIGHT OF STEERABLE NOSE WHEEL

Table 5 is composed of two graphs, showing the additional weight contributed by the Steerable Nose Wheel, for the idler End if the machine and the Power Unit End of the machine. Before using Table 4. determine the distance between the machine travel rails, in feet.

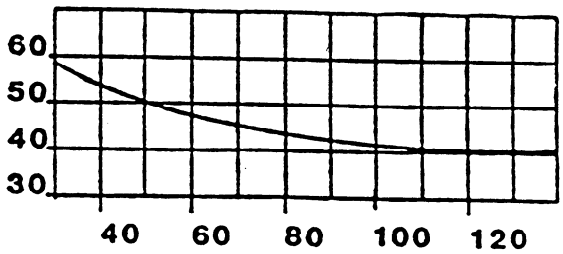
TABLE 5

IDLER END



DISTANCE BETWEEN MACHINE TRAVEL RAILS IN FEET

POWER UNIT END



DISTANCE BETWEEN MACHINE TRAVEL RAILS IN FEET

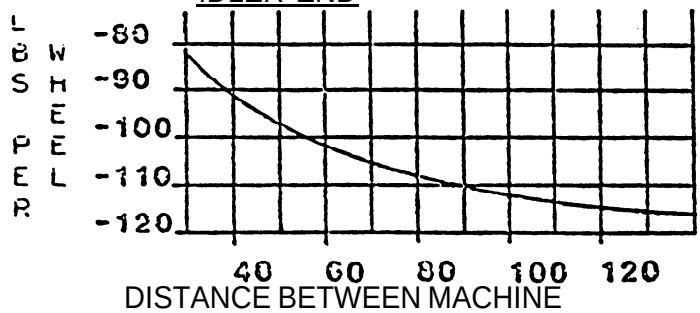
Enter the total weight of the Steerable Nose Wheel, 818 lbs. into the total weight column of line 5. page 5-9. Find the wheel loads for the Idler End and Power Unit End from the graphs and enter those loads into the proper columns of line 5, page 5-9.

5.6.1.6 WEIGHT TRANSFER OF POWER UNIT

Table 6 is composed of two graphs. One graph lists the ADDITIONAL weight that the Power Unit adds to the wheel load on the Power Unit End of the machine. The second graph lists the weight to be DEDUCTED from the idler End of the machine, The total weight of the Power Unit is INCLUDED in the basic machine weight. The longer the total length of the machine, the more the Power Unit weight is transferred to the Power Unit End of the machine, and away from the Idler End of the machine.

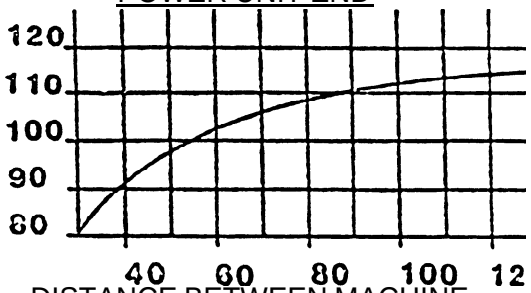
TABLE 6

IDLER END



DISTANCE BETWEEN MACHINE TRAVEL RAILS IN FEET

POWER UNIT END



DISTANCE BETWEEN MACHINE TRAVEL RAILS IN FEET

Find the wheel loads for the Idler End and Power Unit End from the graphs, and enter those loads into the proper columns of line 6. page 5-9.

5.6.2 LIVE LOADS FOR 4800 AND BR SERIES MACHINES

The- finishing carriage, carriage accessories. and the machine operator are considered live loads, because they move from one end of the machine to the other. Therefore, it is necessary to figure that the entire weight of these live loads will be carried by only one end of the machine,

5.6.2.1 BASIC CARRIAGE WEIGHT

Table 7 lists the weights of basic 4800 & BR Series Bid-We11 Roller Finishing Carriages, as assembled at the factory. The weights in Table 7 do not include the weight of any carriage accessories.

TABLE 7

BASIC CARRIAGE	WEIGHT
48101, 48102, BR-101, & BR-102, Single Roller .	1480 lbs
48201, 48202, BR-201, & BR-202, Dual Roller . .	1580 lbs
48202HD & BR-202HD, Dual Roller	1732 lbs

Enter the weight of the basic carriage into the total weight column on line 7, page 5-9. Divide the total weight by 4, to obtain the weight per wheel on the Idler End and the Power Unit End of the machine.

5.6.2.2 WEIGHT OF CARRIAGE ACCESSORIES

Table 8 lists the ADDITIONAL weights that various carriage accessories add to the weight of the basic carriage. These weight figures take into consideration. any basic carriage parts that the accessory replaced.

TABLE 8

ACCESSORY	ADDED WEIGHT	ACCESSORY	ADDED WEIGHT
2nd Drag Pan	(*) 70 lbs	Lift Device	245 lbs
Side Thrust Rollers	(*) 56 lbs	Skew Bar Kit	250 lbs
Latex Pan Vib.	115 lbs	23 HP Engine	50 lbs
4000 Pan Vib.	142 lbs	5500 Spud Vib.	397 lbs
Rol1er Tamper	225 1bs	Vib. Joint Cutter	273 lbs
Trimming Blades (Pair)	502 lbs	(*) Incl. in HD Carriage Weight	

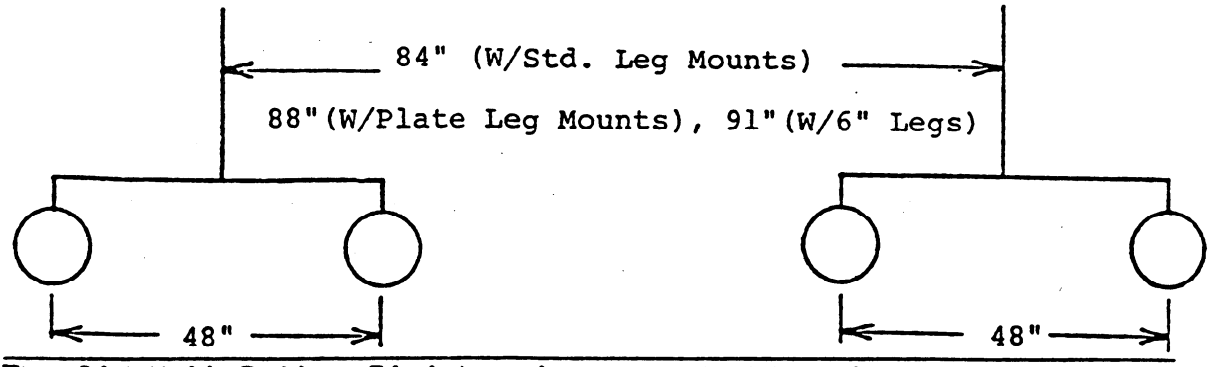
Determine which accessories are going to be installed on the basic carriage. Add the additional weights of those accessories, to obtain the total additional weight of accessdries, Place this weight into the total weight column on line 8, page 5-9. Divide the total weight by 4, to obtain the weight per wheel on the Idler End and The power Unit End of the machine,

5.6.2.3 MACHINE OPERATOR

A weight of 200 pounds has been used as an estimate for a typical operator. If your operator Is heavier than 200 pounds, enter the appropriate weights in line 9, page 5-9. if people, other than the operator, are required to be on the machine, their weights should also be included.

5.7 WHEEL LOADS

5.7.1 BR AND 4800 SERIES MACHINES



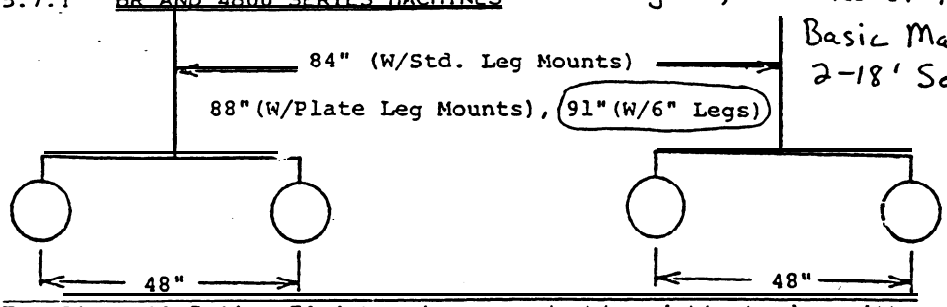
The Bid-Well Roller Finisher is supported by eight wheels, with four to each side as shown above.

	TOTAL WEIGHT lbs		IDLER END lbs/wheel	POWER UNIT END lbs/wheel
DEAD LOADS				
1. Basic machine weight, see Table 1, page 5-5.	_____	/8	_____	_____
2. Add for extra inserts, see Table 2, page 5-5.	_____	/8	_____	_____
3. Add for machine accessories, Table 3, page 5-6.	_____	/8	_____	_____
4. Add for Power-Fold Dolly, see Table 4, page 5-6.	_____		_____	_____
5. Add for Steerable Nose Wheel. Table 5, page 5-7.	_____		_____	_____
6. Add for Stationary Power Unit being closer to one end, Table 6, page 5-7.	XXXXXX		-_____	+_____
LIVE LOADS				
7. Basic Carriage Weight, see Table 7, page 5-8.	_____	/4	_____	_____
8. Add for carriage accessories, Table 8, page 5-8.	_____	/4	_____	_____
9. Add for Machine Operator, see paragraph 5.6.2.3.	200	/4	50	50
TOTAL WEIGHTS (Lines 1 thru 9)	_____ (Pounds)		_____ (lb/wheel)	_____ (lb/wheel)

Sample Calculation for 48', BR-202 with 6" legs, Manual Crown Adjuster, Dual Drag Pans, Power Fold Dolly, 23 hp engines, and Roller Tamper.

5.7 WHEEL LOADS

5.7.1 BR AND 4800 SERIES MACHINES

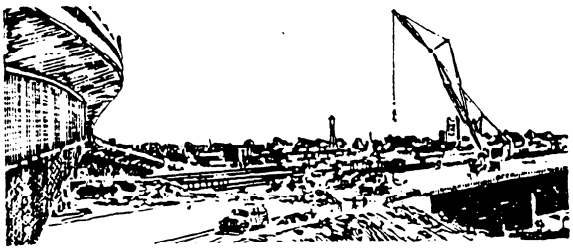


Basic Machine, 2-18' Sections

The Bid-Well Roller Finisher is supported by eight wheels, with four to each side as shown above.

	TOTAL WEIGHT lbs		IDLER END lbs/wheel	POWER UNIT END lbs/wheel
DEAD LOADS				
1. Basic machine weight, see Table 1, page 5-5. (2-18' Sections)	5000	/8	625	625
2. Add for extra inserts, see Table 2, page 5-5. (2-6' with leg rail)	1164	/8	145½	145½
3. Add for machine accessories, Table 3, page 5-6. (6" Legs, Man. Crown Adj., 23 hp engine)	464	/8	58	58
4. Add for Power-Fold Dolly, see Table 4, page 5-6. (44' Between Mach. Travel Rails)	865		38	179
5. Add for Steerable Nose Wheel. Table 5, page 5-7.	—		—	—
6. Add for Stationary Power Unit being closer to one end. Table 6, page 5-7.	XXXXXX		- 95	+ 95
LIVE LOADS				
7. Basic Carriage Weight, see Table 7, page 5-8. (BR-202 Carriage)	1580	/4	395	395
8. Add for carriage accessories, Table 8, page 5-8. (2nd Drag Pan, 23 hp Eng., Roller Tamper)	345	/4	86¼	86¼
9. Add for Machine Operator, see paragraph 5.6.2.3.	200	/4	50	50
TOTAL WEIGHTS (Lines 1 thru 9)	9618 (Pounds)		1311¾ (lb/wheel)	1633¾ (lb/wheel)

APPENDIX 5



BRIDGE CONSTRUCTION MEMO 100-3.0

CONCRETE MATERIALS AND MIXING

April 30, 1986

Volume II

TRANSIT-MIXED CONCRETE

In order to insure that batching and mixing of concrete which is placed in the permanent structures complies with the contract specifications, the following instructions covering inspections and documentation are to be followed.

Batch Plant Inspection

Each batch plant which furnished concrete to the project must be inspected for full compliance with the specifications. Document the inspection on Form DH-OS C54, or a similar district form, At least one plant inspection report must be in the project files before a significant portion of the work is done. Inspection reports are interchangeable between projects,

Batching and Mixing

Check the procedure for batching, charging mixers, mixing, delivery and discharge to insure that properly batched and mixed concrete is placed. This checking should be done at the beginning of the job and as often thereafter as conditions warrant. Document the checking by a separate diary covering the day or days on which it was done,

At least once during each concrete placing operation check the transit mix truck revolution count to verify proper mixing. Document the check(s) by an entry in the "Remarks" block of "Field Record for Concrete Pours" Form DH-OS C72 or the "Concrete Pour Record" Form DH-OS C73. Record the numbers of the trucks checked, time and results of check, In case of non-compliance indicate the action taken,

Load Tickets

At least once during each concrete placing operation check the load ticket for conformance with specification requirements. The checking of the tickets must be done at the time the truck arrives at the job site. Document this checking by indicating on the ticket that it has been checked, date, time, mixing revolution count and signature of the inspector.

Checking of Batch Weights

As provided in Section 90-5.03 of the Standard Specifications, the accuracy of batch weights shall be checked periodically by weighing a loaded transit mixer on platform scales, and after discharge weighing the empty truck to determine the tare and calculate the weight of the total batch. This weight should be compared with the weight of the materials placed in the truck at the batch plant. Corrective measures will be taken if the two weights are not in close agreement. This checking shall be done in conjunction with a unit weight test. The frequency of this check will depend on local conditions, but at least one check must be made every six months.

Since checks of this type are for the purpose of checking the accuracy of scales of a particular batch plant, the result of a check may be used for more than one project. Proper documentations must be in the files of each project concerned. In remote areas where there are no platform scales readily available, other means of checking the batch weights, or waiving of the check, may be authorized by the Structure Representative or the Bridge Construction Engineer. When different checking methods are used, or the checking is waived, this fact should be documented in the project records.

Variations in the prescribed procedure, to comply with local. district policy, or to avoid duplication of effort, are authorized provided the extent of checking and documentation are not adversely affected.

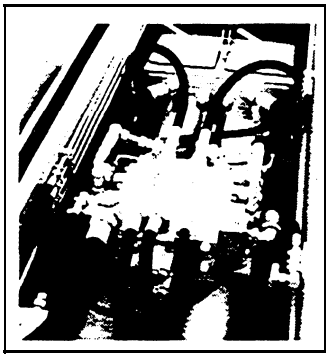
Rejected Transit-Mixed Concrete

When it is found necessary to reject transit-mixed concrete because it is improperly mixed, has excessive slump, is over-age, etc., the necessary steps must be taken to ascertain that the rejected concrete is not used elsewhere on the contract from which it was rejected, nor on any other adjacent State contracts.

SCHWING
AMERICA INC.

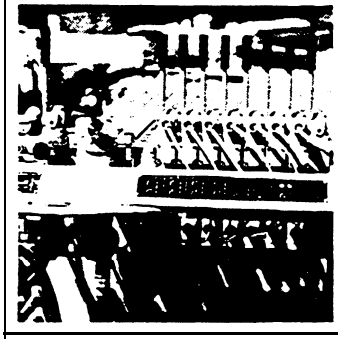
Truck mounted concrete pump with placing boom 1200 HDR KVM 42

The features you need for reliable concrete pumping with confidence at up to 196 cubic yards per hour

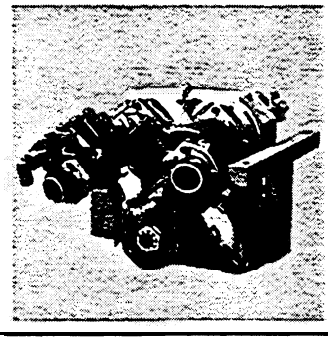


Hydraulic control block is the proven Schwing design providing millions of hours of service. This simple foolproof unit switches hydraulic flow without troublesome electronic devices.

Completely sealed waterbox for flushing cylinders features easy access for inspecting and changing pumping rams.

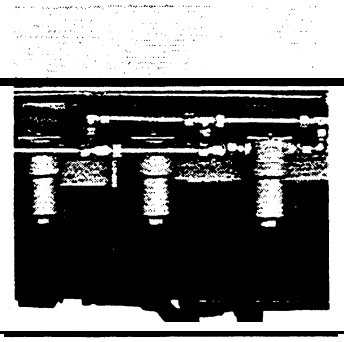


Controls for boom and pump are conveniently located for easy operator access on the pump's wide deck.

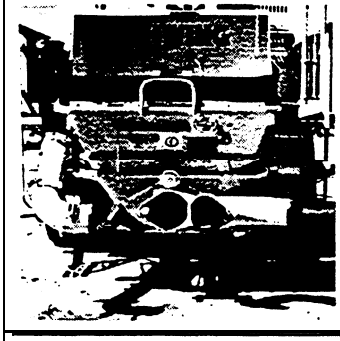


Unsurpassed reliability is based on Schwing-designed hydraulic system and Hydromatik hydraulic pump. Auxiliary pumps provide hydraulic pressure for agitator, water pump, boom, outriggers and optional air compressor.

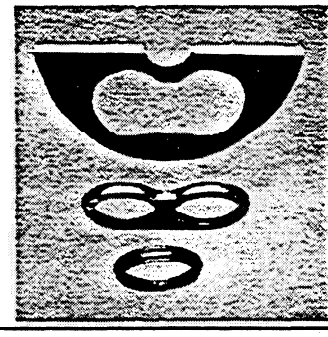
Fully hydraulic outriggers for fast and simple set-up and excellent stability in all boom positions. Outrigger controls are located on opposite sides of the unit. Operators can observe outrigger extension during set-up.



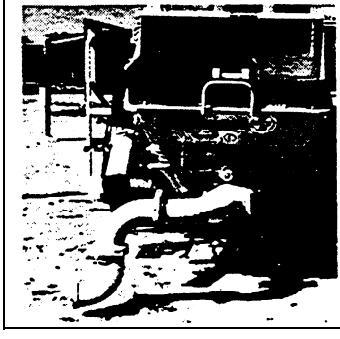
Easy access hydraulic filters screen down to 10 microns to protect system from contaminants.



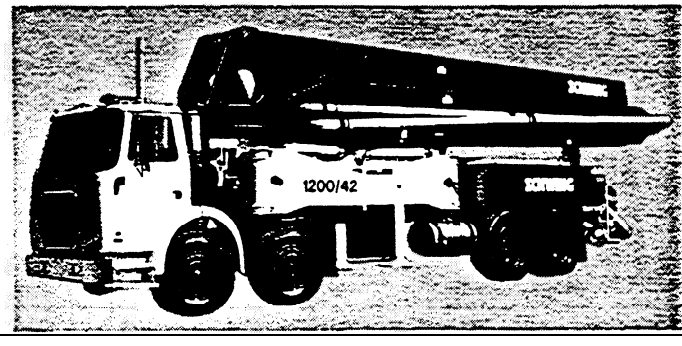
Discharge pipe swings away for fast. effective cleaning of the Rock Valve and housing. Convenient hinged clean-out doors are also incorporated.

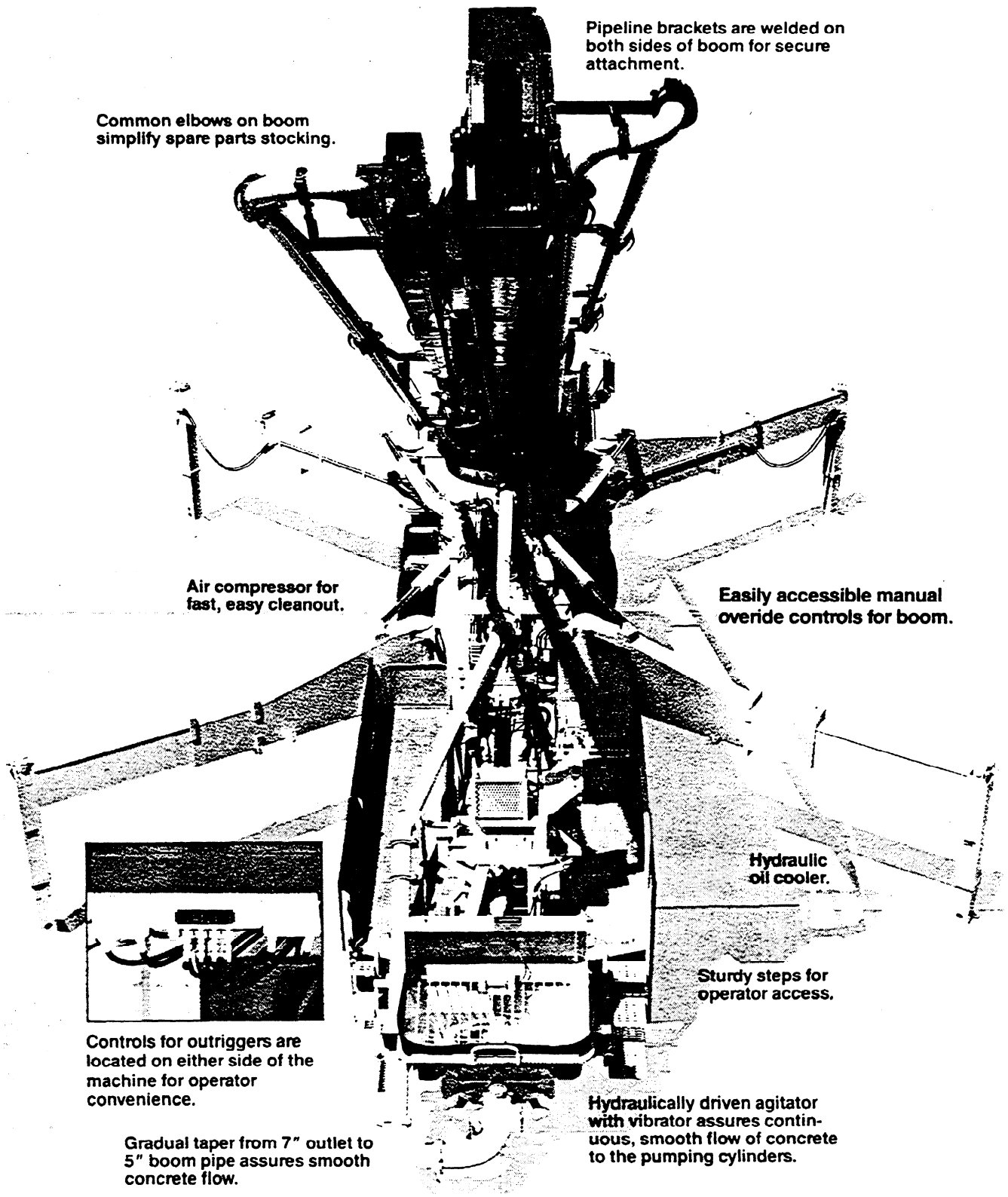


New 3-piece cutting ring design cuts cost for Rock Valve wear parts replacement. High quality tool steel assures long wear life.



Convert your Schwing from boom pump to line pump with the addition of a simple 90-degree outlet. This allows full utilization of the pump for high-pressure, long distance placements.



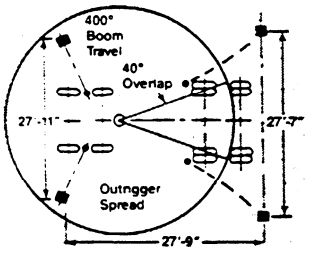

Pipeline brackets are welded on both sides of boom for secure attachment.
Common elbows on boom simplify spare parts stocking.
Air compressor for fast, easy cleanout.
Easily accessible manual overide controls for boom.
Hydraulic oil cooler.
Sturdy steps for operator access.
Controls for outriggers are located on either side of the machine for operator convenience.
Hydraulically driven agitator with vibrator assures continuous, smooth flow of concrete to the pumping cylinders.
Gradual taper from 7" outlet to 5" boom pipe assures smooth concrete flow.

Here's the most successful long boom in America for highrise, flatwork and bridges

Design

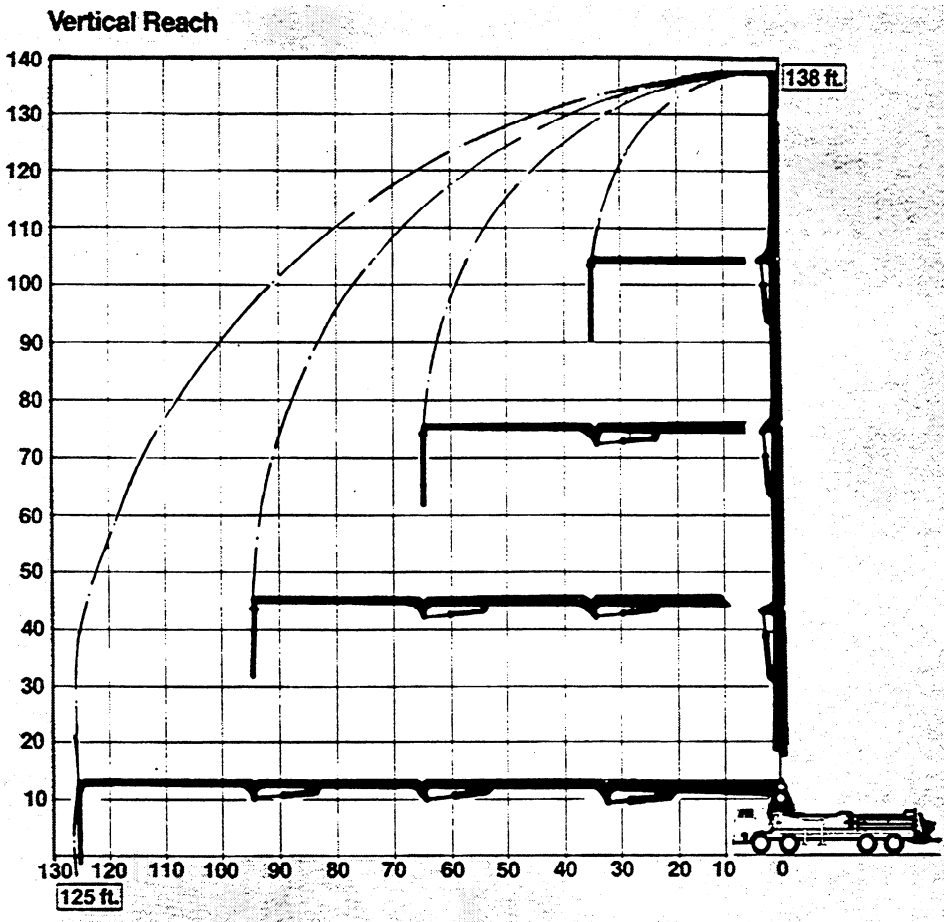
Schwing's fully articulating Roll and Fold boom allows concrete placement to all points with the slewing radius. Place straight out. straight up or downward and to all points between without dead spots or restricted posit ions.

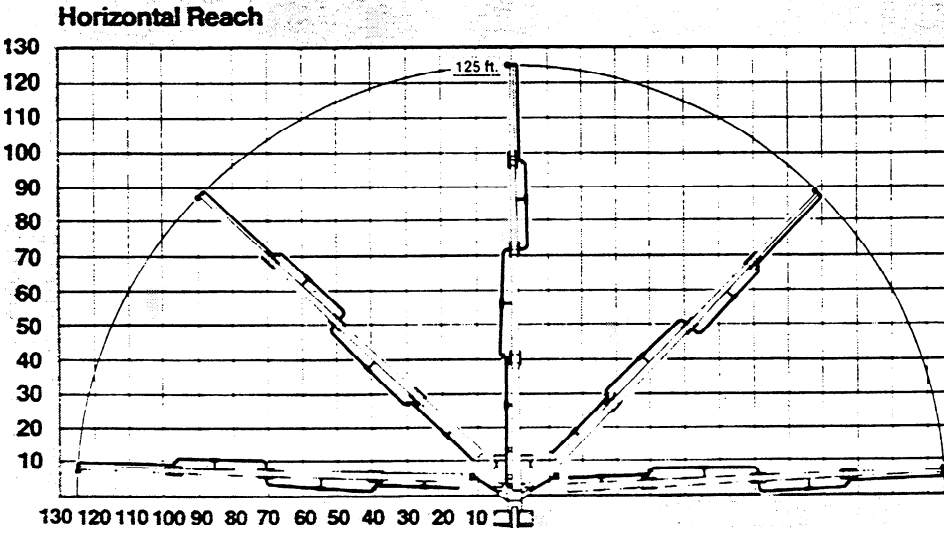
Wireless remote control allows up to five boom functions to be performed simultaneously. Unit can also be operated with 100-foot cable included with control box.

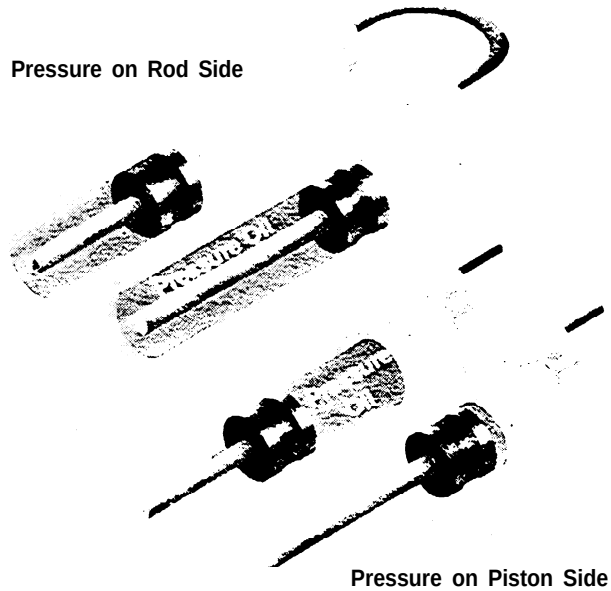


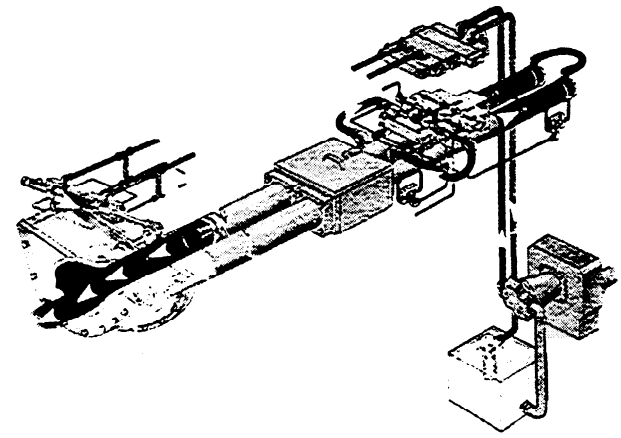
Maximum stability in the smallest space is provided by the outriggers

Schwing 42-meter boom reaches a full 125 feet horizontally for maximum coverage 0' flatwork and slabs







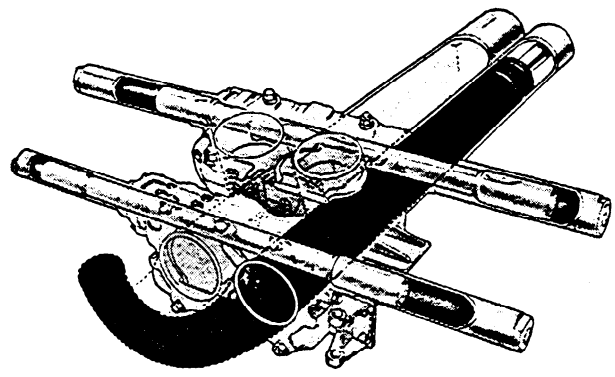


The BPL 1200 HDR is equipped with a hydraulic system which can be changed to provide greater volume of concrete or greater vertical and/or horizontal pumping distances. Hydraulic pressure is applied to the rod side of the cylinder piston head for greater volume or to the face of the piston head (high pressure side) for greater distance. This feature is only available on Rock Valve equipped units used for line pumping.

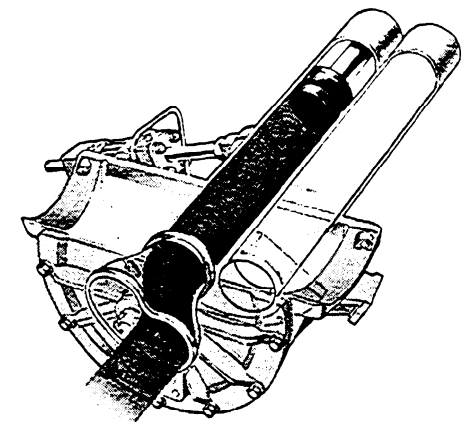
The twin-cylinder reciprocating pump pulls concrete from the hopper on the return stroke and pushes it into the pipeline on the forward stroke. The twin pistons alternate with long, stow stroking action to maintain a near constant pressure on the concrete. Cylinders can be switched end to end to extend wear life.

The ever popular and highly successful Gate Valve continues to be offered for specific applications and customer preference.

The revolutionary Rock Valve pumps everything from the harshest mixes to grout. Its unique design equalizes all forces in the valve, pumping concrete against the concrete, greatly reducing valve wear, while providing extraordinary sealing efficiency to prevent bleeding of fines. Valve cutting ring can be easily rotated 90 degrees for extended life.



Gate Valve



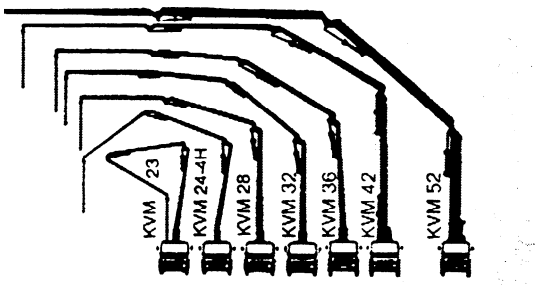
Rock Valve

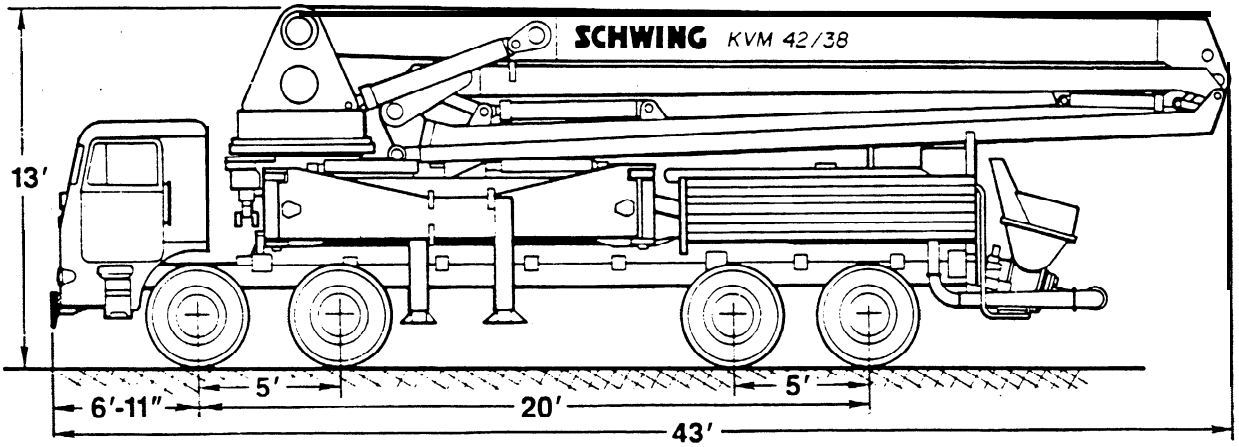
Technical Data

Concrete pump		1200 HDR
Theoretical Concrete Output, Hourly	Rod Side Piston Side	128-196 CY 83-111 CY
Max. Pressure on Concrete	Rod Side Piston Side	640 PSI 1165 PSI
Max. Horizontal Pumping Distance	Rod Side Piston Side	1000-Ft. 1700-Ft.
Max. Vertical Pumping Distance	Rod Side Piston Side	260-Ft. 480-Ft.
Max. Strokes/Min.	Rod Side Piston Side	30 17
Pump Cylinder Diameter		9
Pump Cylinder Stroke Length		79-in.
Max. Aggregate Size		2.5-in
Min. Concrete Slump		0-in
Placing boom		**KVM 42**
Pipeline diameter (inches)		5
Vertical reach (feet)		138
Horizontal reach (feet) from slewing axis		125
Reach from front of truck (feet)		115
Section Lengths First Section		33'10"
Second Section		30'4"
Third Section		30'4"
Fourth Section		30'4"
Slewing range (degrees)		400°
End hose length (feet)		12.5

Specifications are subject to change without prior notice.

FULL LINE





Represented by

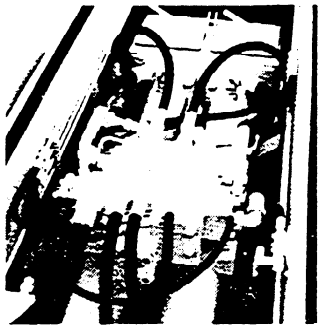
SCHWING AMERICA INC.

5900 Centerville Road
White Bear, MN 55127
612-429-0999
TWX 910-563-3539
FAX 612-429-3464

SCHWING
AMERICA INC

Truck mounted concrete pump with placing boom
BPL 900 HDR 1200 HDR
KVM 36

Concreting with confidence at up to 196 cubic yards per hour



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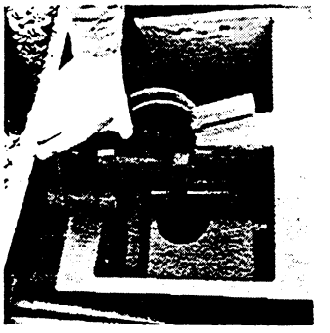
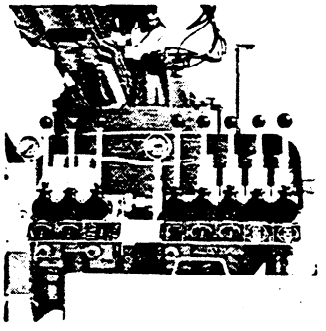
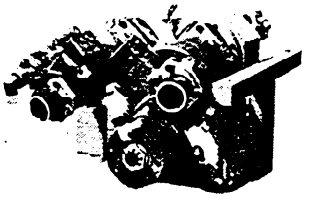


Completely sealed waterbox for flushing cylinders features easy access for inspecting and changing pumping rams.



Controls for boom and pump are conveniently located for easy operator access on the pump's wide deck.



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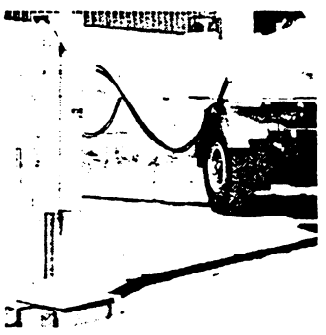

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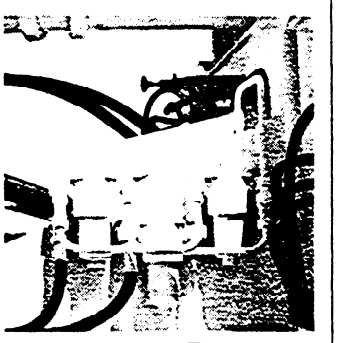

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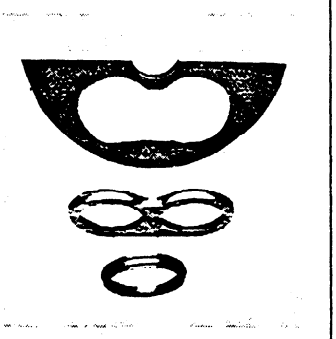

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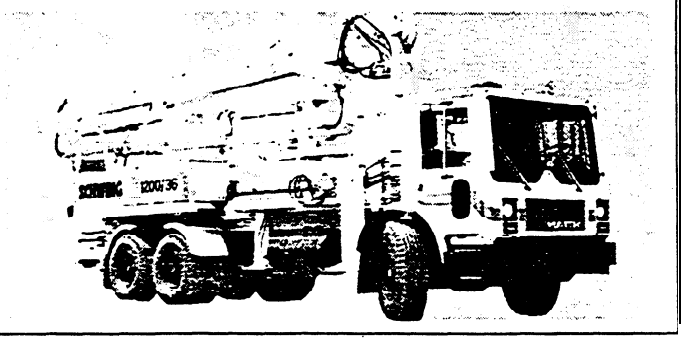

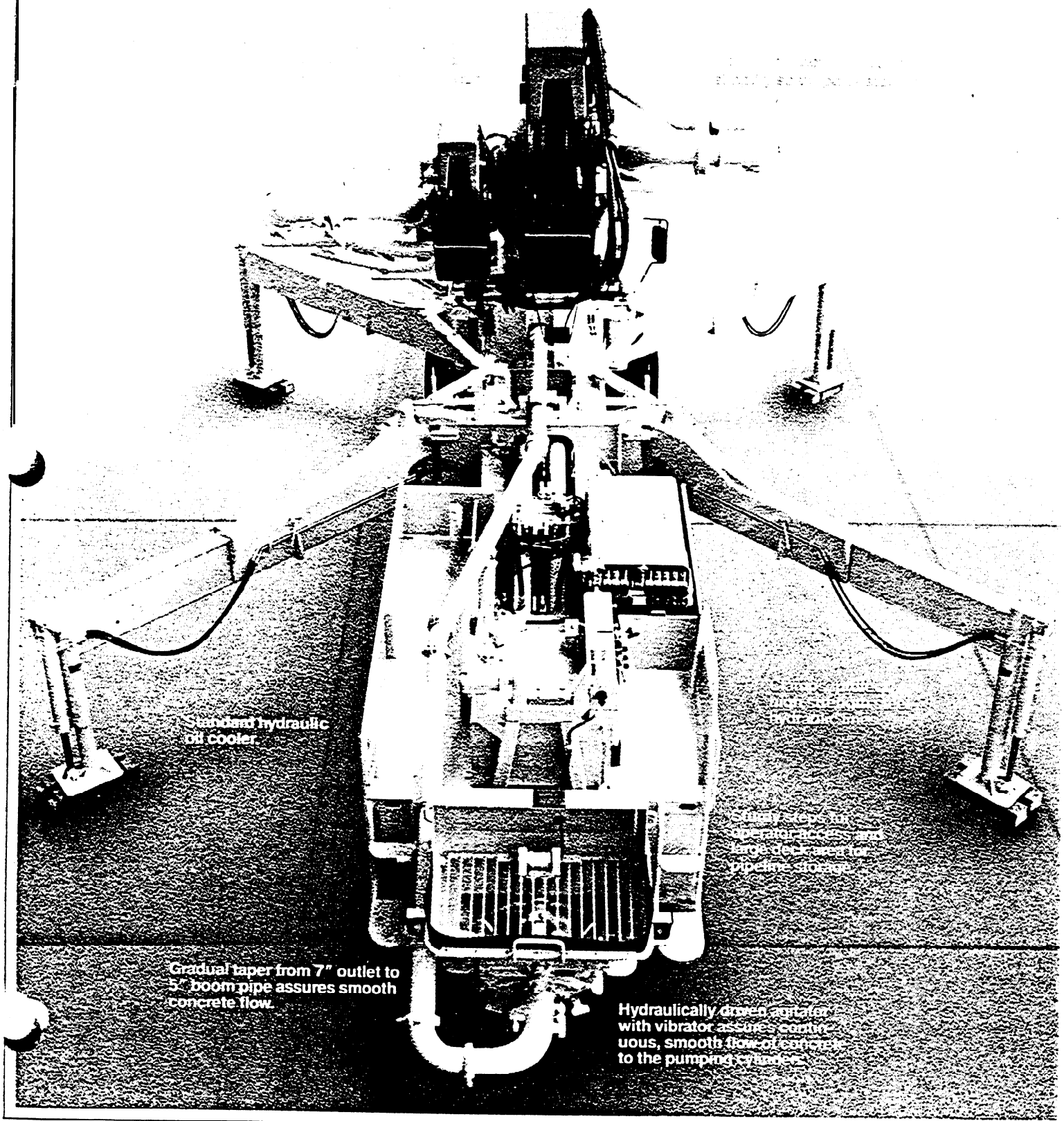
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A boom working range for highrise, flatwork and bridges

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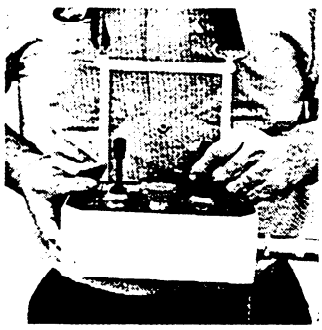
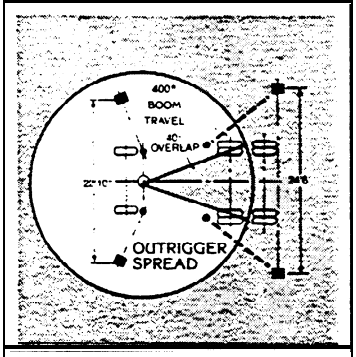
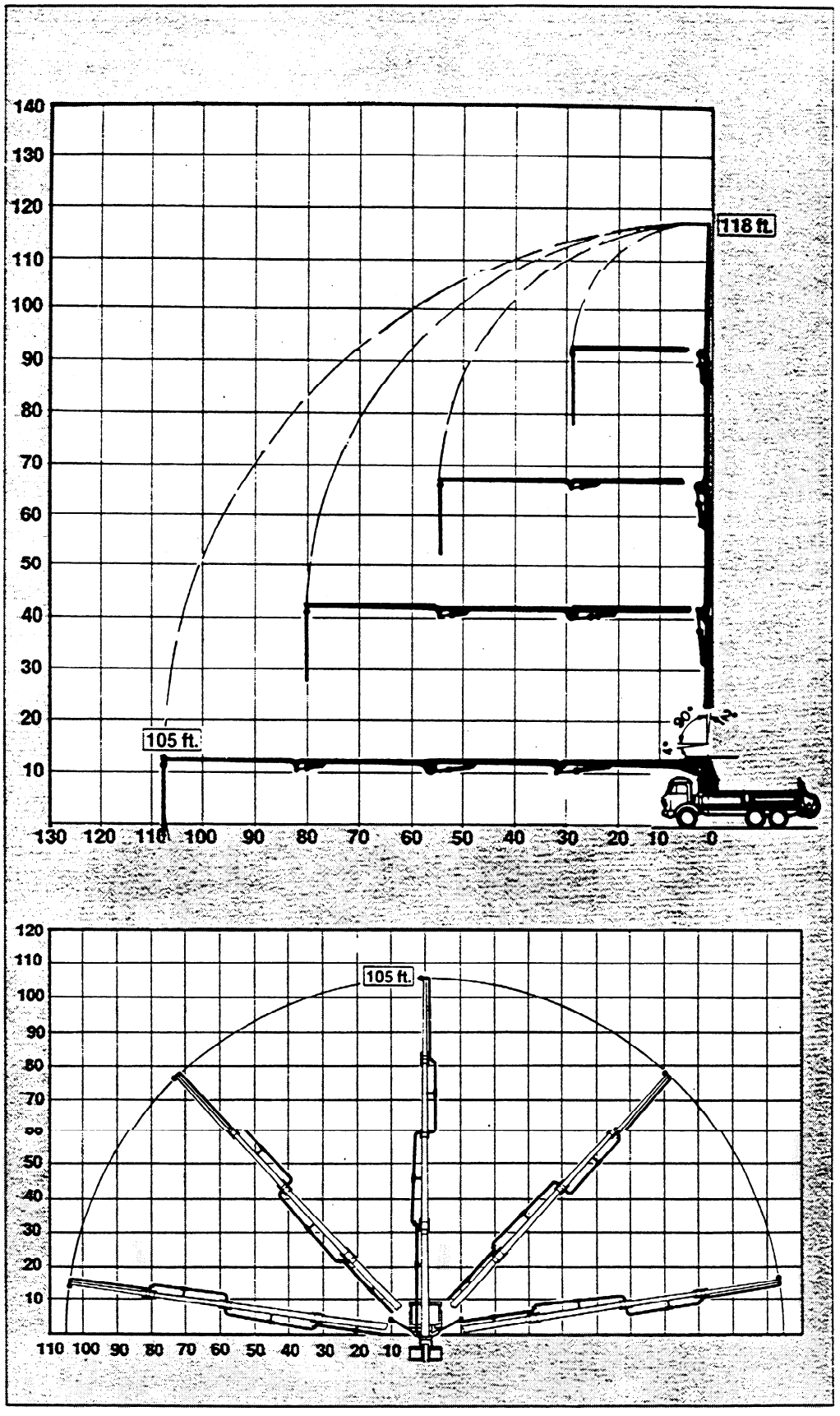


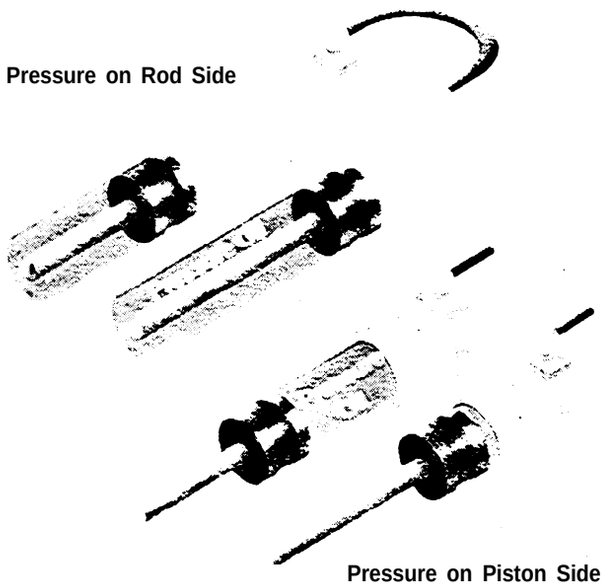
Remote control allows up to five boom functions to be performed simultaneously with 130-feet of extension cable standard. (Wireless remote optional.)

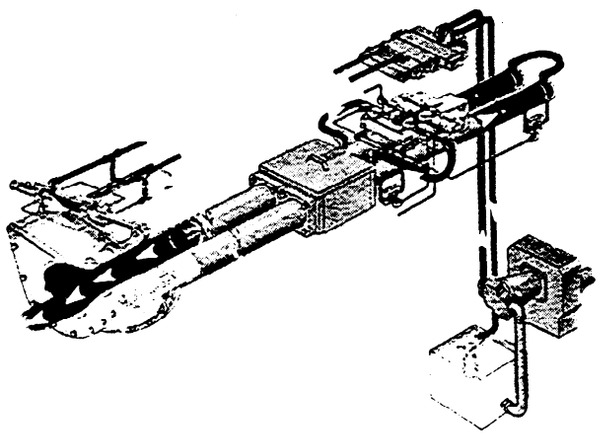


Maximum stability in the smallest space is provided by the outriggers.

Schwing 36-meter boom reaches a full 105 feet horizontally for maximum coverage of flatwork and slabs.







The BPL 900 HDR and BPL 1200 HDR are equipped with a hydraulic system which can be changed to provide greater volume of concrete or greater vertical and/or horizontal pumping distances. Hydraulic pressure is applied to the rod side of the **cylinder** piston head for greater volume or to the face of the piston head (high pressure side) for greater distance. This feature IS only available on Rock Valve equipment units used for line pumping.

The twin-cylinder reciprocating pump pulls concrete from the hopper on the return stroke and pushes it into the pipeline on the forward stroke. The twin pistons alternate with long, slow stroking action to maintain a near constant pressure on the concrete. Cylinders can be switched end to end to extend wear life.

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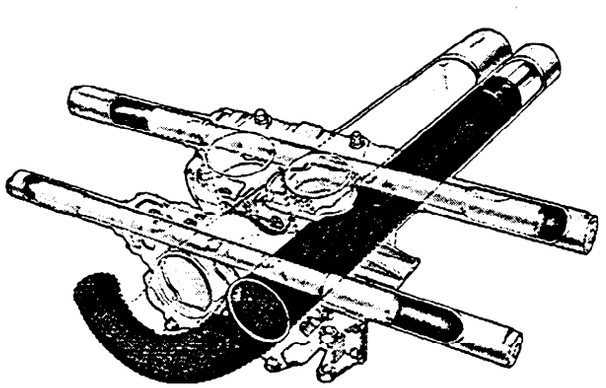
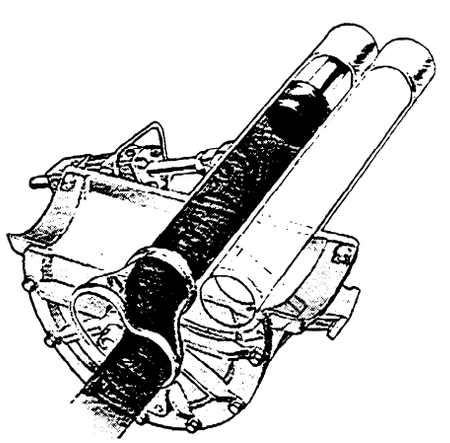


Gate Valve



Rock Valve

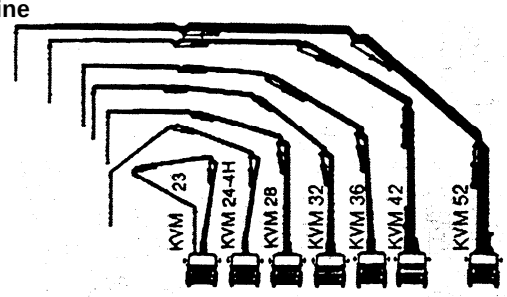
Technical Data

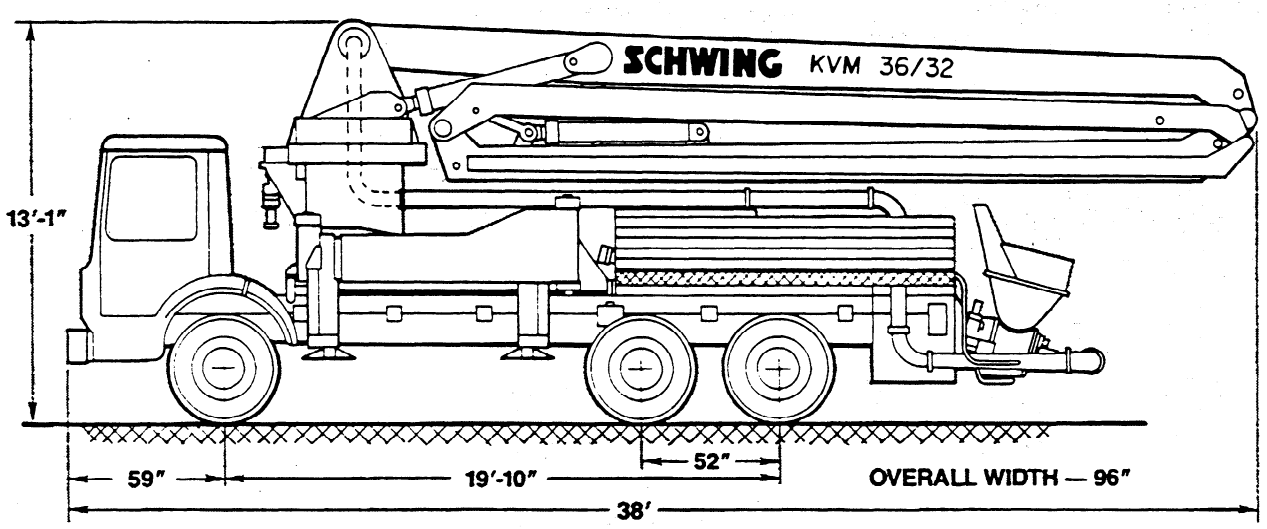
Concrete pump		900 HDR	1200 HDR
Theoretical Concrete Output, Hourly	Rod Side Piston Side	117 CY 67 CY	113-196 CY 83-111 CY
Max. Pressure on Concrete	Rod Side Piston Side	850 PSI 1536 PSI	640 PSI 1805 PSI
Max. Horizontal Pumping Distance	Rod Side Piston Side	950-Ft. 1700-Ft.	1000-Ft. 1500-Ft.
Max. Vertical Pumping Distance	Rod Side Piston Side	260-Ft. 450-Ft.	250-Ft. 420-Ft.
Max. Strokes/Min.	Rod Side Piston Side	30 17	23 15
Pump Cylinder Diameter		8	9
Pump Cylinder Stroke Length		63-in.	79-in.
Max. Aggregate Size		2.5-in.	2.5-in.
Min. Concrete Slump		0-in.	0-in.

Placing boom	KVM 36
Pipeline diameter (inches)	5
Vertical reach (feet)	118
Horizontal reach (feet) from slewing axis	105
Reach from front of truck (feet)	95
Section Lengths First Section	27′
Second Section	26′
Third Section	26′
Fourth Section	26′
Slewing range (degrees)	370°
End hose length (feet)	12.5

Specifications are subject to change without prior notice.

Full line





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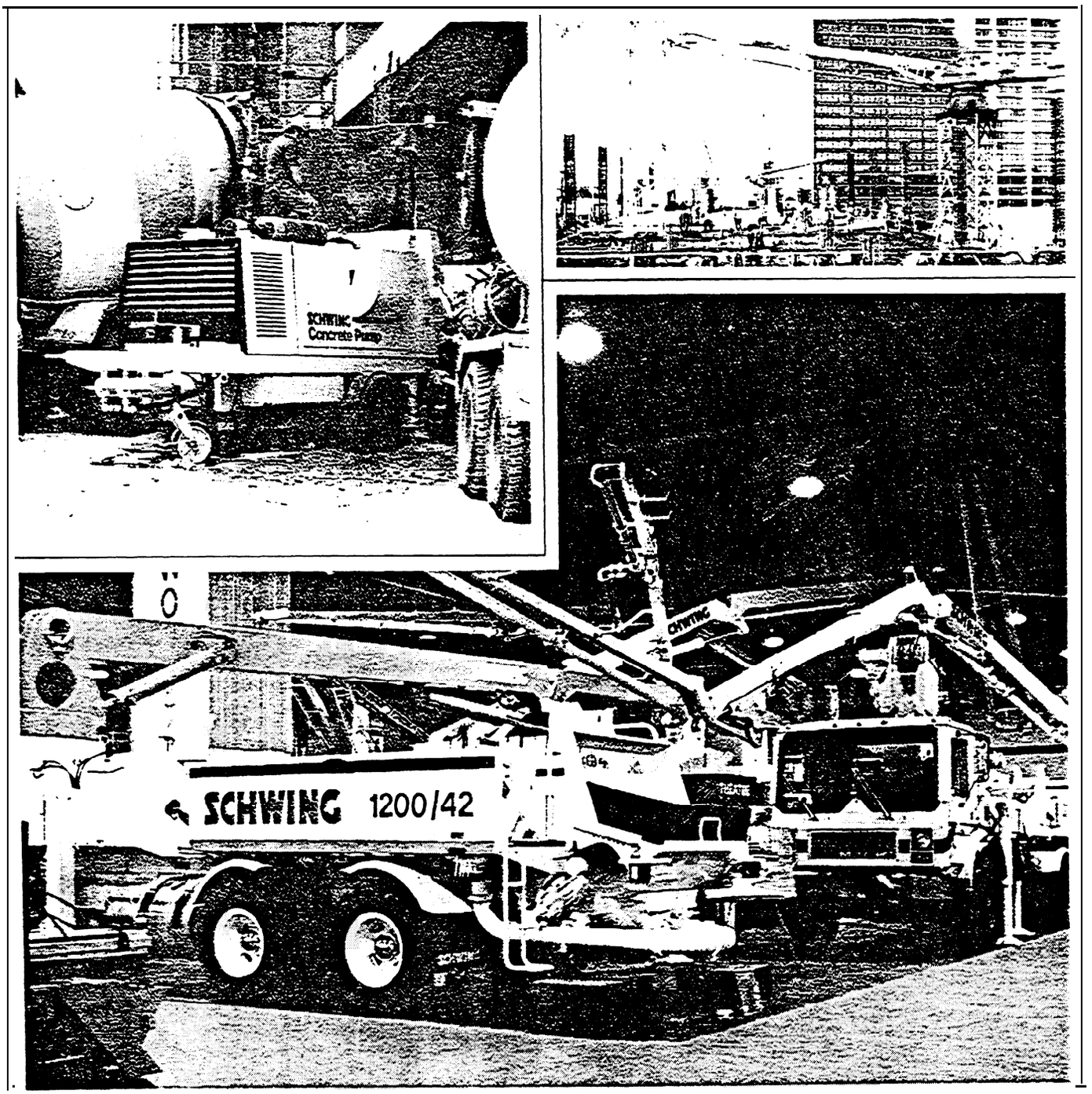
SCHWING
AMERICA INC.

Concrete pumps and placing booms Full Line

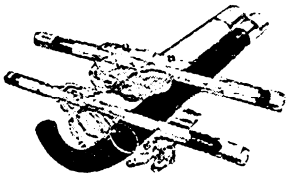


More than 1200 SCHWING boom pumps are operating successfully in North America. .

Two proven valve types

Rock Valve

Gate Valve

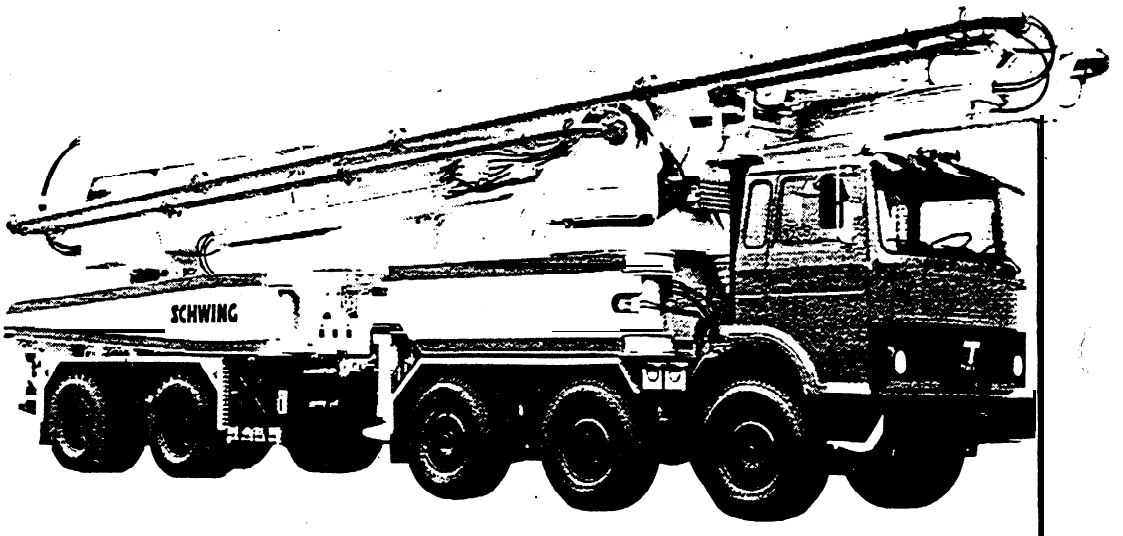


Only Schwing offers two proven valves for most models. Both valves pump a variety of mixes with exceptional reliability and low wear. Your Schwing representative will assist you in deciding which valve is best suited to your application.

K V M 5 2

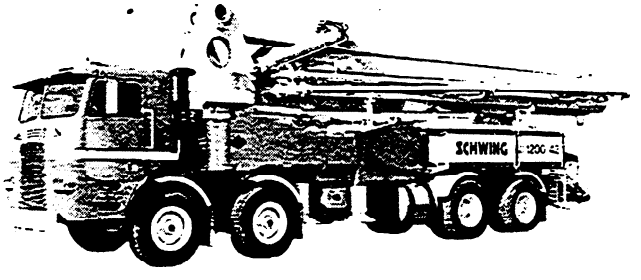
- **170 foot 4 section boom**
- **available with 1200 HDR Pump**

The reach of our 4-section 52 meter boom allows versatility for single set-up and efficient placement on highrise and flatwork. This extra long boom is mounted on a three steering axle chassis for maneuverability



KVM 42

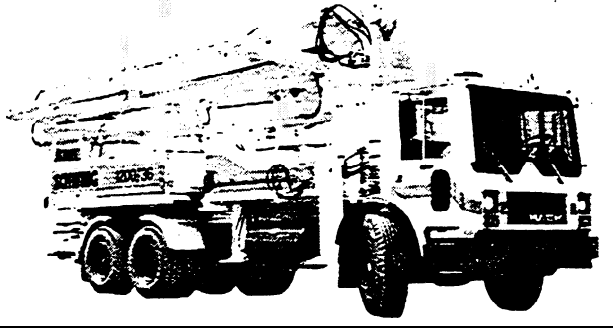
- **138-foot, 4 section boom**
- **available with 1200 HDR Pump**



Here's the 4-section long boom with all-around performance for fast, easy placement of bridge decks, slabs and buildings. Operator conveniences abound on the 42-meter which has an outstanding history of acceptance throughout the United States.

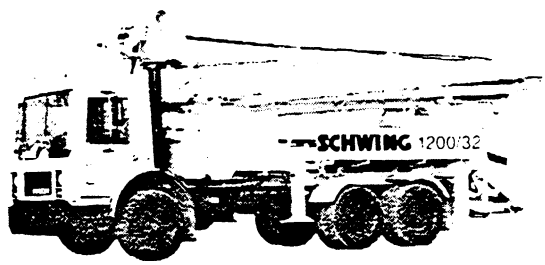
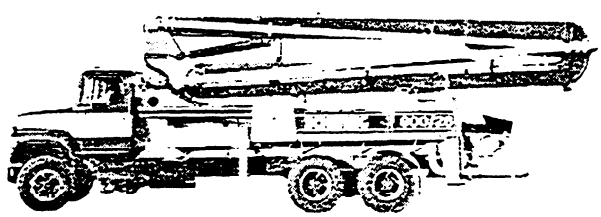
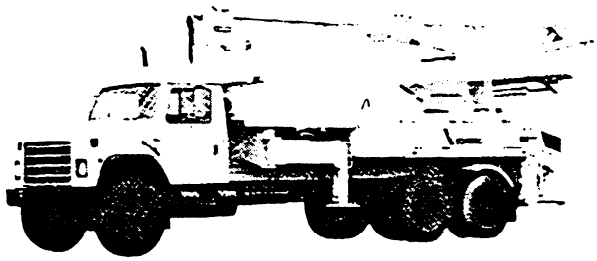
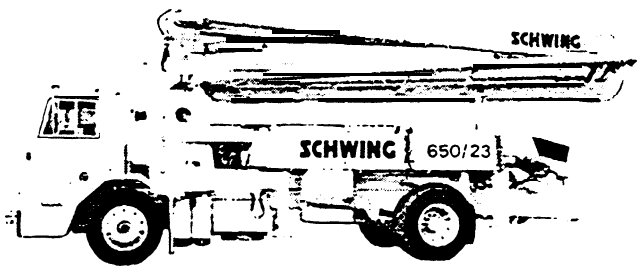
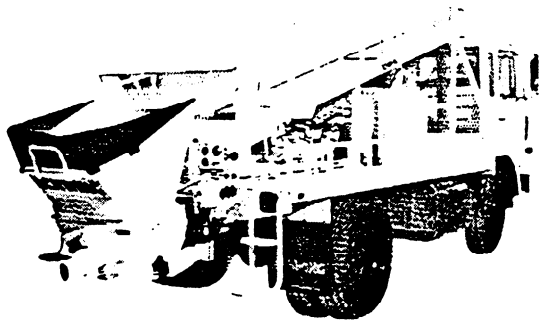
KVM 36

- **118 foot, 4 section boom**
- **available with 1200 HDR Pump**

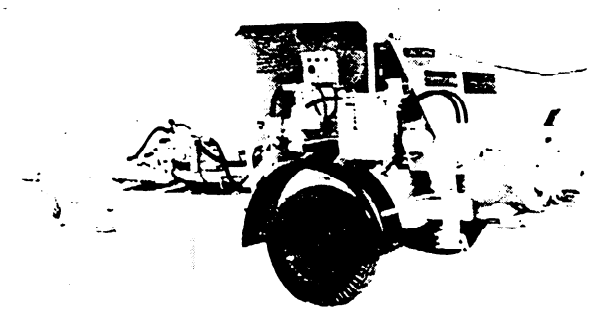
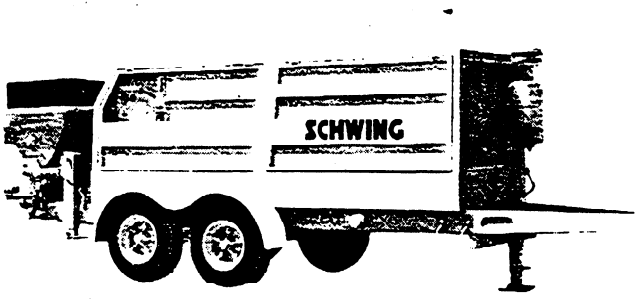
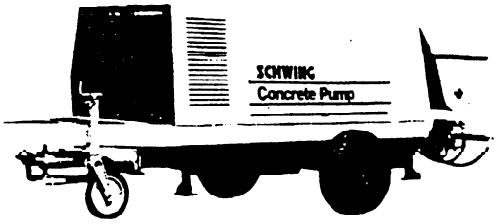
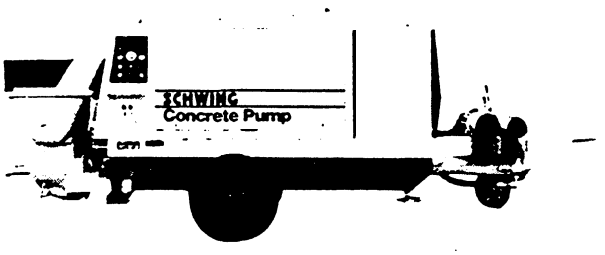
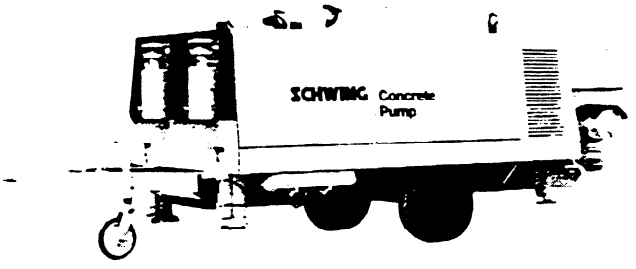


Full 4-section boom flexibility with reach to accomplish many pour requirements. The 35 meter mounts on a three axle chassis for cost efficiency while providing an excellent cost/performance value.

Backed by a nationwide distributor organization for reliable parts and service

KVM 32 • 105-foot, 4 section boom • available with 900 HDR or 1200 HDR pump		The 32-meter is a compact, four section boom design with big pump performance. Fast set-up and proven reliability make this unit ideal for most pump applications.
KVM 28 • 92-foot, 3 section boom • available with 801 HD, 900 HDR, and 1200 HDR pumps		The 28-meter boom model remains the most popular with the reach and output that means workhorse performance. The boom is detachable and mounts on standard separate placing boom towers and pedestals.
KVM 24 H • 79-foot, 4 section boom • available with 801 HD or 900 HDR pump		This 4-section boom is unique with its extremely low 16'2" unfolding height for placing in confined areas. The boom also features quick detach for remote mounting.
KVM 23 • 75-foot, 3 section boom • available with 650 HDR or 801 HD pump		Here's the quick hitter that offers excellent output through a 23-meter boom. Single axle truck mounting benefits maneuverability and economy.
BPL 750/1000		Convenient racks carry the pipeline for set-up on the project. This compact unit utilizes the truck engine for power to pump exceptional distances. Separate engine drive is also available.

SCHWING trailer mounted concrete pumps

BPA 750 **BPA 1000**		This small pump is a big performer in 750 or 1000 configuration. Both units equipped with the proven Rook Valve for reliable pumping of hardrock concrete or grout.
BPA 650 **BPA 901**		These all purpose pumps are available with Rock or Gate Valve and with six, seven or eight-inch diameter pumping cylinders for high volume or high pressure work. Choose diesel or electric power depending on your application.
BPA 3000 HDD		Pump at super-high pressures continuously with this unit featuring the proven Schwing Gate Valve. Choose diesel or electric power for vertical placements to 1,000 feet and horizontal pumping to 3,000-feet.
BPA 3000 HDR **BPA 3001 HDR**		This pump operates at pressures for everyday performance on highrise placements to 1,000-feet vertically or horizontal pumping to 3,000 feet. Many different configurations incorporating various pumping cylinder sizes and Rock Valve allow versatility for many pumping applications.
BPA 5000		Twin engine design puts the 5000 series in a class by itself for pumping long distances at high pressures. Six configurations are available to suit virtually every demanding pumping application. Available with both the Rock Valve and Gate Valve.

Specifications

BPL MODEL TRUCK MOUNTED PUMPS	650 HDR	801	900 HDR	1200 HDR-20†		1200HDR-23†	
Theoretical Concrete Output (C.Y./Hr.) Rod Side	86	107	117	128	147	171	196
Piston Side			67	78	83	104	111
Max. Pressure on Concrete (PSI) Rod Side	782	867	850	995	850	740	640
Piston Side			1535	1675	1535	1265	1165
Max. Horizontal Pumping Distance (Ft.)* Rod Side	850	1000	950	1100	1000	850	700
Piston Side			1700	1850	1700	1400	1300
Max. Vertical Pumping Distance (Ft.)* Rod Side	250	260	260	300	260	230	200
Piston Side			450	520	480	390	300
Max. Strokes/Min. Rod Side	36	31	30	26	30	26	30
Piston Side			17	16	17	16	17
Pump Cylinder Diameter (In.)	7	8	8	8		9	
Pump Cylinder Stroke Length (In.)	47	55	63	79		79	
Max. Aggregate Size (In.)**	1.5	2.5	2.5	2.5		2.5	
Min. Concrete Slump (In.)**	0	0	0	0		0	

* Pumping distances shown are to be used as a guide only since they have been considerably exceeded on specific projects. Maximum attainable distances depend upon concrete mix design and pipeline diameter. Maximum output and distance cannot be achieved simultaneously.
** Minimum slump and maximum aggregate size are dependent upon concrete mix design and pipeline diameter.
Pump specifications are for standard units. Other units are available.
† Model 1200 pumps available with optional differential cylinders for specific applications.

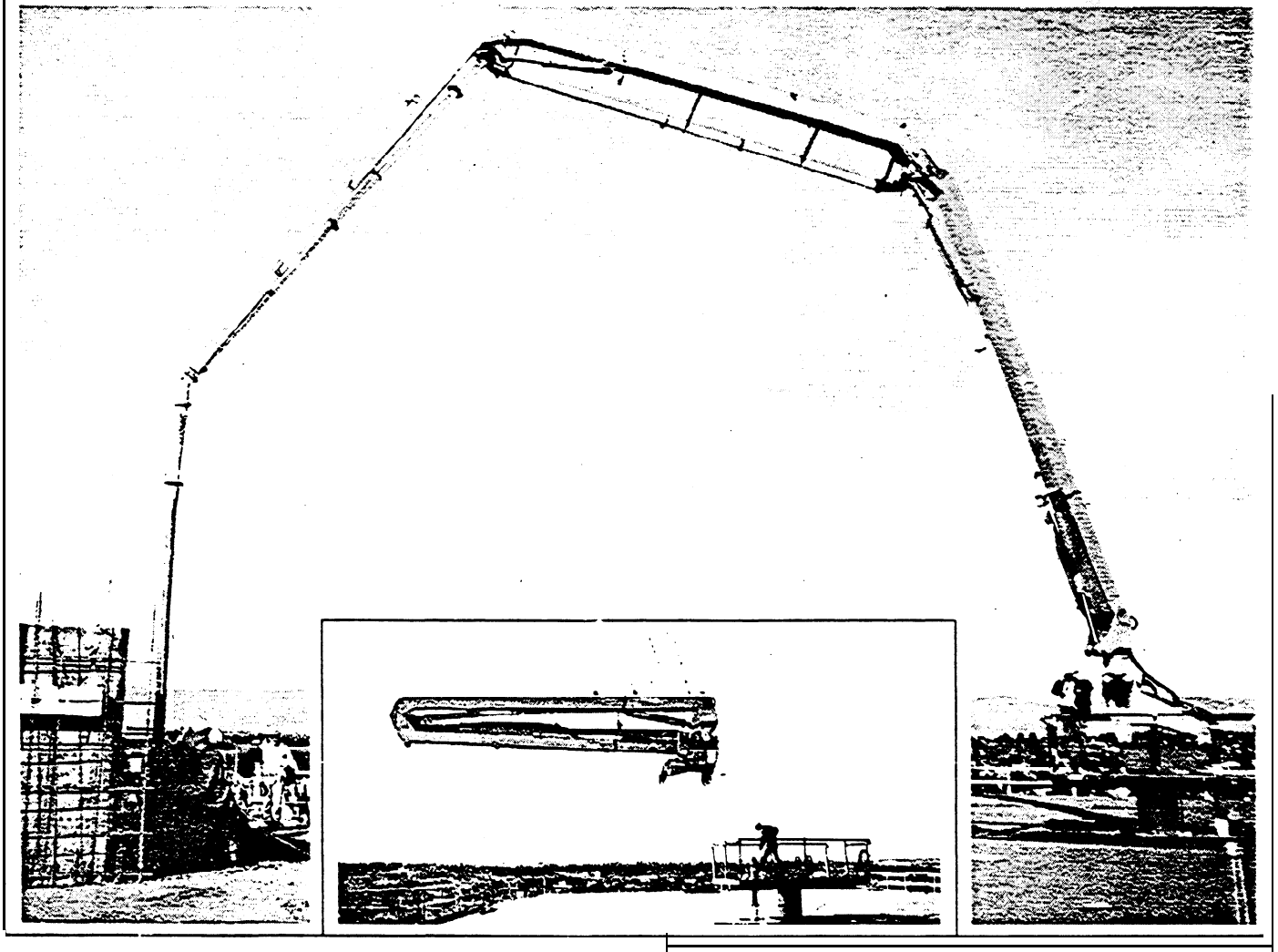
BPA MODELS		750R	1000R	650 HDD		650 HDR-18	901		3000 HDD		3000 HDR		3001 HDR		5000 HDD		5000 HDR		5000 HPR	
				-15	-18		D	R	-15	-20	-18	-20	-18	-20	-15	-20	-18	-20	-15	-18
Max. Theoretical Concrete Output (C.Y./Hr.)	(R)								68	118	102	126	102	126	87	150	128	157	87	128
	(P)	42	70	62	89	92	135	139	42	71	60	75	60	75	54	94	79	98	54	79
Max. Pressure on Concrete (PSI)	(R)								1700	985	1215	985	1215	985	1700	985	1215	985	1700	1215
	(P)	950	853	1542	1070	1070	867	867	2860	1666	2057	1666	2057	1666	2860	1666	2057	1666	2860	2057
Max. Horizonal Pumping Dist. (Ft.)*	(R)								2000	1000	1250	1000	1250	1000	2000	1000	1250	1250	2000	1250
	(P)	1000	940	2300	1300	1300	1000	1000	3000	1750	2100	1750	2100	1750	3000	1750	2100	2100	3000	2100
Max. Vertical Pumping Dist. (Ft.)*	(R)								500	300	350	300	350	300	500	300	350	350	500	350
	(P)	300	255	600	350	350	250	250	1000	450	575	450	575	450	1000	450	600	600	1000	600
Max. Strokes/Min.	(R)								30	30	32	32	32	32	40	39	40	40	40	40
	(P)	30	35	32	32	33	38	40	18	18	19	19	19	19	25	24	25	25	25	25
Pump Cylinder Dia. (In.)		6	7	6	7	7	8	8	6	8	7	8	7	8	6	8	7	8	6	7
Pump Cylinder Stroke Length (In.)		39	39	55	55	55	55	55	63	63	63	63	63	63	63	63	63	63	63	63
Max. Aggregate Size (In.)**		1½	1½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½
Min. Concrete Slump (In.)**		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Pumping distances shown are to be used as a guide only since they have been considerably exceeded on specific projects. Maximum attainable distances depend upon concrete mix design and pipeline diameter. Maximum output and distance cannot be achieved simultaneously.
** Minimum slump and maximum aggregate size are dependent upon concrete mix design and pipeline diameter.
Pump specifications are for standard units. Other units are available.
R = Rod Side
P = Piston Side

Separate Placing Booms

Concrete placement for floors, walls and columns is easily and quickly accomplished wrth Schwing Separate Placing Booms mounted on crane towers, fixed pedestals or hydraulic self-climbing pedestals. Booms can be "flown" from one location to another, easily covering the entire area. KVM 28 can be ordered as a truck-mounted unit with pump and removed for pedestal or tower mounting

SEPARATE PLACING BOOM SPECIFICATIONS	KVM 28/24-125	DVM 32-125	DVM 42-125
Diameter of Pipeline (In.)	5	5	5
Max. Horizontal Reach (Ft.)	79	105	138
Number of Boom Sections	3	3	3
Main Boom Section	29'-1"	40'	66'2"
Middle Section	26'-5"	36'-9"	36'-7"
Tip Section	24'-3"	28'-3"	28'-2"
Slewing Range (Degrees)	370°	370°	720°
Boom End Hose Length (Ft.)	12	12	12
Boom Coverage @ 360° Radius (Sq. Ft.)	19,546	34,618	59,798



Represented by

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FAX 612-429-3464

APPENDIX 6

DEPARTMENT OF TRANPORTATION
DIVISION OF CONSTRUCTION
Office of Transportation laboratory
P. 0. Box 19128
Sacramento, California 95819
(916) 444-48000

California Test 547
1978

OPERATION OF BRIDGE PROFILOGRAPH AND EVALUATION OF PROFILES

A. SCOPE

The operation of the Bridge Profilograph, the procedure for determining the "counts per 100 feet" from the profilograms, and the procedure for locating individual high points in excess of a 'specified limit are described in Parts I, II, and III respectively of this test method.

PART 1-OPERATION OF THE BRIDGE PROFILOGRAPH

A. EQUIPMENT

The Bridge Profilograph consists of a frame 12 feet long supported on one wheel at each end with an outrigger wheel for balancing support (see Figure 1). The profile is recorded from the vertical movement of a wheel attached at the midpoint of the frame and is in reference to the mean elevation of the end wheels in contact with the deck surface. The profilogram is recorded on a scale of one inch equal to 15 feet longitudinally, and one inch equal to one inch vertically. Motive power is supplied manually from the push handle in the rear. Steering is accomplished by rotating the handle grip to move the front wheel.

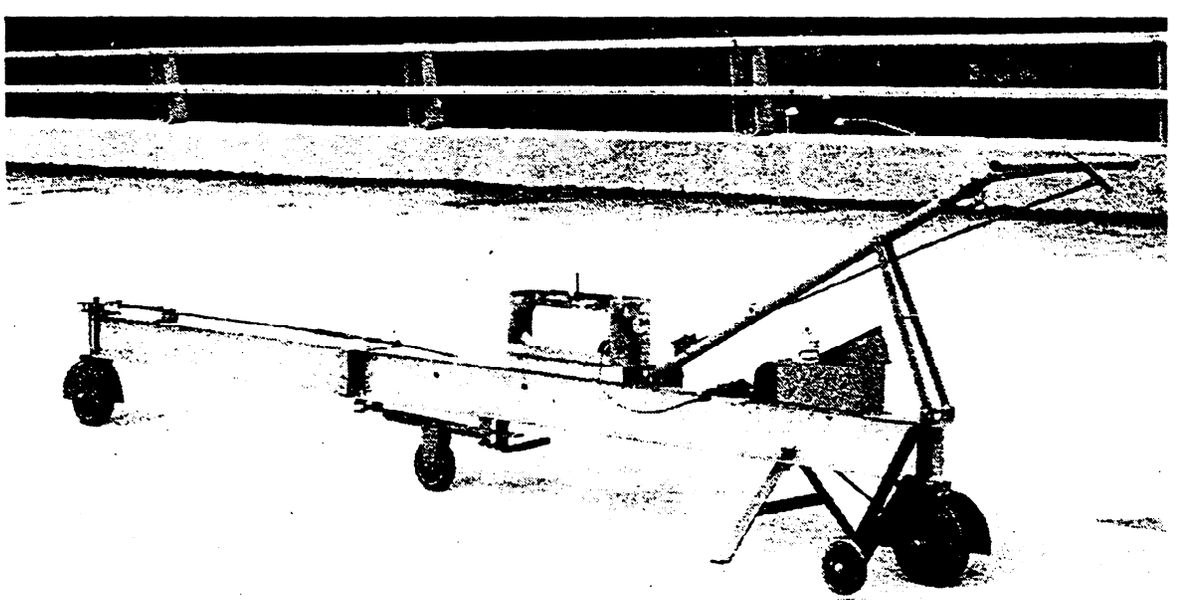

FIGURE 1. BRIDGE PROFILOGRAPH

B. OPERATION

The Bridge Profilograph is transported in two pieces which readily bolt together. The recorder is mounted by use of two spring clips on each end. A cable is connected from the profile wheel to the recorder for the vertical scale movement and a speedometer cable hookup to the rear wheel is used for the horizontal scale movement.

In operation, the profilograph should be moved at a speed no greater than a walk. Too high a speed will result in a profilogram that is difficult to evaluate. The deck surface should be swept clean of any loose

material along the paths to be profiled, and the wheels should be kept clean and free of particles which may become imbedded in the tires. Initial profiles should normally be obtained at approximately each planned wheel path of each traffic lane.

Calibration of the profilograph should be checked periodically. The horizontal scale can be checked by running a known distance and scaling the result on the profilogram. If the scale is in error of more than 22 percent, the rear wheel of the profilograph should be replaced with one of proper diameter. The vertical scale is checked by putting a board of known thickness under the profile wheel and again scaling the result on the profilogram. If the scale is in error, the cause of the incorrect height should be determined and corrected.

PART II-DETERMINATIONS OF COUNTS PER 100 FEET FROM PROFILOGRAMS

A. PROCEDURE

To determine the "counts per 100 feet", use a plastic scale 1.70 inches wide and 6.66 inches long to represent a bridge deck length of 100 feet at a scale of l"= 15'. Such a plastic scale may be obtained from the Transportation Laboratory, Sacramento. Near the center of the scale is an opaque blanking band OX-inch wide extending the entire length of 6.66 inches. On either side of this band are scribed lines 0.l-inch apart, parallel to the opaque band. These lines serve as a conventient scale to measure deviations of the profile line above or below the blanking band. These deviations are called "scallops".

B. METHOD OF COUNTING

Place the plastic scale over the profile in such a way as to "blank out" as much of the profile as possible. When this is done, any scallops that appear above and below the blanking band will be approximately balanced (see Figure 2).

Starting at the right end of the scale, measure and total the height of all the scallops appearing both above and below the blanking band, measuring each scallop to the nearest 0.05% inch (half a tenth). Write this total on the profile sheet near the left end of the scale together with a small mark to align the scale when moving to the next section. Short portions of the profile line may be visible outside the blanking band but unless they project 0.03inch or more and extend longitudinally for 0.1%inch or more on the profilogram, they are not included in the count. (See Figure 2 for illustration of these special conditions.)

When scallops occurring in the first 100 feet are totaled, slide the scale to the left, aligning the right end of the scale with the small mark previously made, and proceed with the counting in the same manner. The last section counted may or may not be an even **100** feet. If not, the last section should be scaled to determine its length and then that portion of 100 feet should be prorated to equivalent 100 feet. For example:

Section Length	Counts, Tenths of an Inch per 100 Ft.
100 feet	4.0
100 feet	3.0
100 feet	2.0
60 feet (2.0 counts in 60 ft. prorated to 100)	3.33

C. LIMITATIONS OF COUNT IN 100 FOOT SECTIONS

When the specifications limit the profile count in "any 100-foot section", the scale is moved along the profile and counts made at various locations to find those sections, if any, that do not conform to specifications. The limits are then noted on the profile and can be later located on the deck surface prior to grinding.

D. LIMITS OF COUNTS

Profiles of the first and last 6 feet of the section being tested cannot be obtained until the adjoining pavement or bridge section is in place. At such time that the concrete bridge approach pavement is to be evaluated, profiles should be obtained starting at least 60 feet prior to each structure or approach slab continuously to at least 25 feet onto the bridge deck.

PART III-DETERMINATION OF HIGH POINTS

A. EQUIPMENT

Use a plastic template having a line 1.33 inches long scribed on one face with a small hole or scribed mark at either end, and a slot a specified distance from and parallel to the scribed line (Figure 3). (The 1.33-inch line corresponds to a horizontal distance of 20 feet on the horizontal scale of the profilogram.) The plastic template may be obtained from the Transportation Laboratory, Sacramento.

B. LOCATING POINTS IN EXCESS OF THE SPECIFIED LIMIT

At each prominent peak or high point on the profile trace, place the template so that the small holes or scribe marks at each end of the scribed line intersect the profile trace to form a chord across the base of the peak or indicated bump. The line on the template need'not be horizontal. With a sharp pencil, draw a line using the narrow slot in the template as a guide. Any portion of the trace extending above

this line will indicate the approximate length and height of the deviation in excess of the specified limit.

There may be instances where the distance between easily recognizable low points is less than 20 feet. In such cases, a shorter chord length shall be used in making the scribed line on the template tangent to the trace at the low points. It is the. intent, however, of this requirement that the baseline for measuring the height of bumps will be as nearly 20 feet as possible, but in no case to exceed this value. When the distance between prominent low points is greater than 20 feet, make the ends of the scribed line intersect the profile trace when the template is in a nearly horizontal position. A few examples of the procedure are shown in Figure 3.

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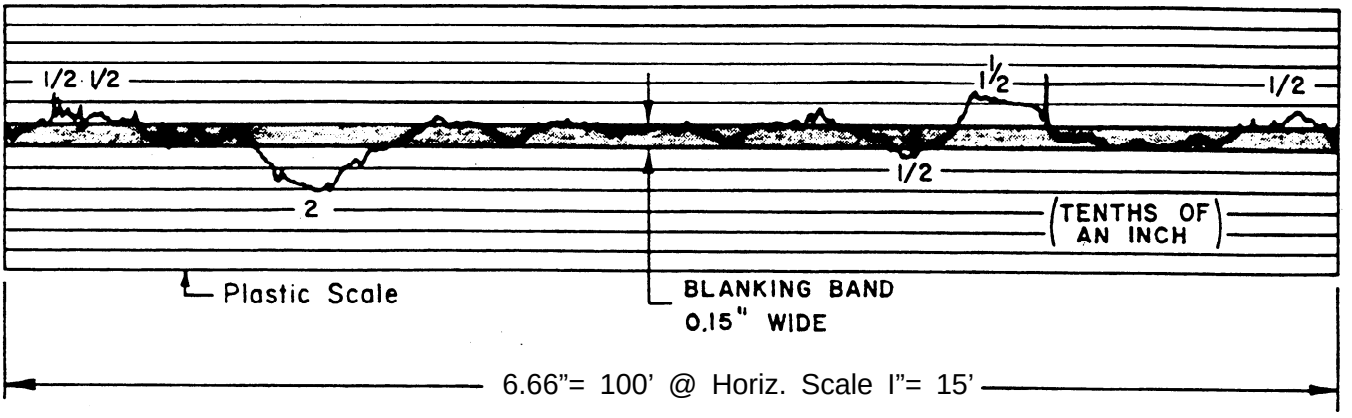
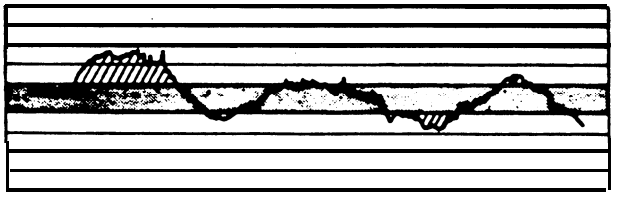
METHOD FOR OBTAINING PROFILE COUNTS



-Total count for 100' section is 5½

TYPICAL CONDITIONS

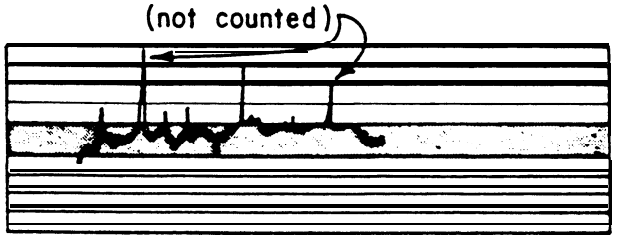
Scallops are areas enclosed by profile line and blanking band



Small projections which are not included in the count

SPECIAL CONDITIONS

Rock or dirt on deck (not counted)



Double peaked scallop (only highest part counted)

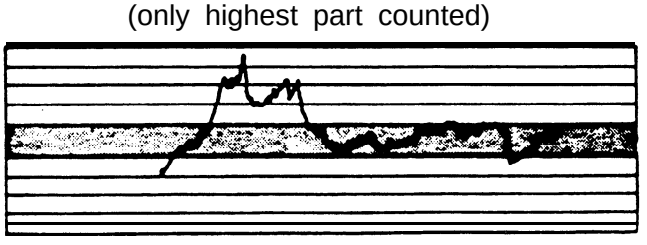
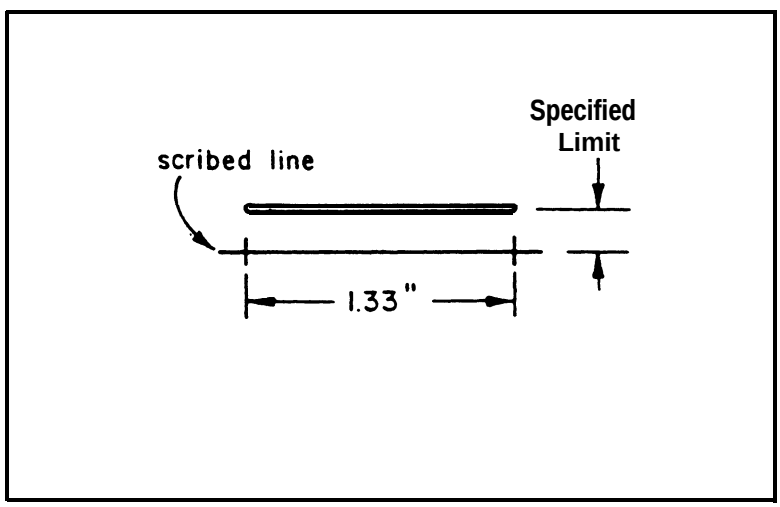
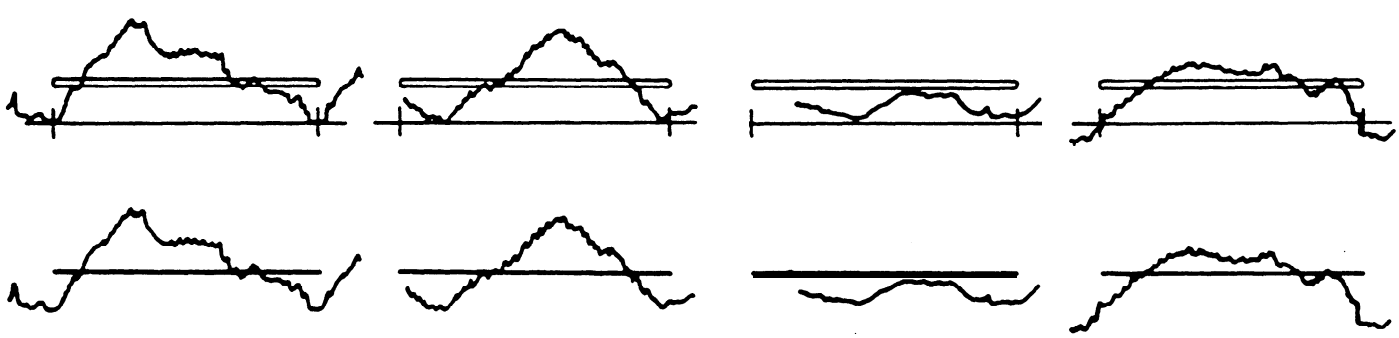


FIGURE 2

METHOD FOR PLACING TEMPLATE WHEN LOCATING BUMPS TO BE REDUCED



PLASTIC BUMP TEMPLATE



Baseline approx. 20 feet

Baseline less than 20 feet

Peak less than limit

Baseline more than 20 feet

FIGURE 3

Pressure Injection Crack Sealing

The following procedure is used to seal surface cracks not meeting the surface intensity crack specification:

1. Cracks are cleaned out with compressed air.
2. l/4" wide strips of masking tape are placed transversely across the cracks at approximately 6" O.C.
3. The top of the cracks are sealed with a two-component polyester compound to which limestone flour and Cab-o-sil (inert filler) are added for body. The seal is supposedly capable of resisting a pressure of 300 psi, although this high a pressure is seldom, if ever, necessary. (Chlorinated rubber curing compound does not seem to affect the bonding of the seal.)

   The strips of masking tape are removed before the seal hardens.

   Injection of two-component epoxy is made progressively along the crack through the openings made by the tape. (The epoxy components are dispensed and separately discharged to a mixing chamber immediately ahead of the nozzle. The nozzle is equipped with a rubber tip to form a seal. Nozzle pressure will vary from about 50 to 250 psi, depending on the size

of the crack and the degree of contamination). Injection is continued at each opening until the epoxy flows from the adjacent opening. The opening- at the point of injection is then sealed by rubbing cold paraffin over the surface.

6. After curing, the polyester seal is removed by a bump or traffic stripe grinder. (Sand-blasting (a) will not remove the seal material completely, (b) is time consuming and (c) damages the adjacent concrete.)

Damaurier MICRO-MIKE

Inspection and Measuring Microscopes

10x : 20x : 40x : 50x

Micro-Miker, designed and manufactured by DuMauricr Company, are the product of over thirty years experience in the dcvclopment of pocket microscopes for industrial, educational and scientific use Repeat orders from leading industrial corporations. U.S. Government, atomic energy and space research centers, Army and Navy Ordnance, and thousands of lesser users are evidence of their quality, accuracy and versatility. *Tests* prove that imported imitations art far below DuMaurier standards of construction, performance and actual value.

Available in four powers, with or without measuring scales, they fulfill almost any requirement for critical inspection of fine details. Scale patterns are integral with the optical system and appear superimposted on the object viewed. Stock scales *include* inch-decimal, millimeter-decimal, cross-hair and 360 degree protractor. Special patterns also can be supplied.

Micro-Mikes are obtainable direct from the manufacturer or through leading optical jobbers. On quantity orders the microscope body can be inscribed to suit the purchaser.

SPECIFICATION and PRICES ***Order by Model number.**

Model*	Power	Field	Scale	Price
1356	10x	.265 inch	None	$5.95
1357	10x	265 inch	.005 inch	7.95
1357M	10x	6.8 mm	.1 mm	7.95
1357X	10x	.265 inch	Cross-hair	7.95
1357P	10x	.265 inch	Protractor	7.95
1352	20x	.190 inch	None	$5.95
1354	20x	.190 inch	.002 inch	7.95
1354M	20x	4.8 mm	.1 mm	7.95
1354X	20x	.190 inch	Cross-hair	7.95
1354P	20x	.190 inch	Protractor	7.95
1353	40x	.082 inch	None	$ 8.95
1355	40x	.082 inch	.001 inch	12.95
1355M	40x	2.1 mm	.1 mm	12.95
1355M2	40x	2.1 mm	.02 mm	12.95
1355X	40x	.082 inch	Cross-hair	12.95
1355P	40x	.082 inch	Protractor	12.95
1358	50x	.065 inch	None	$10.95
1359	50x	.065 inch	.001" & .1 mm	13.95

DU MAURIER COMPANY P.O. Bo.x 4010 Virginia Beach, Va. 23454